The Mining Journal

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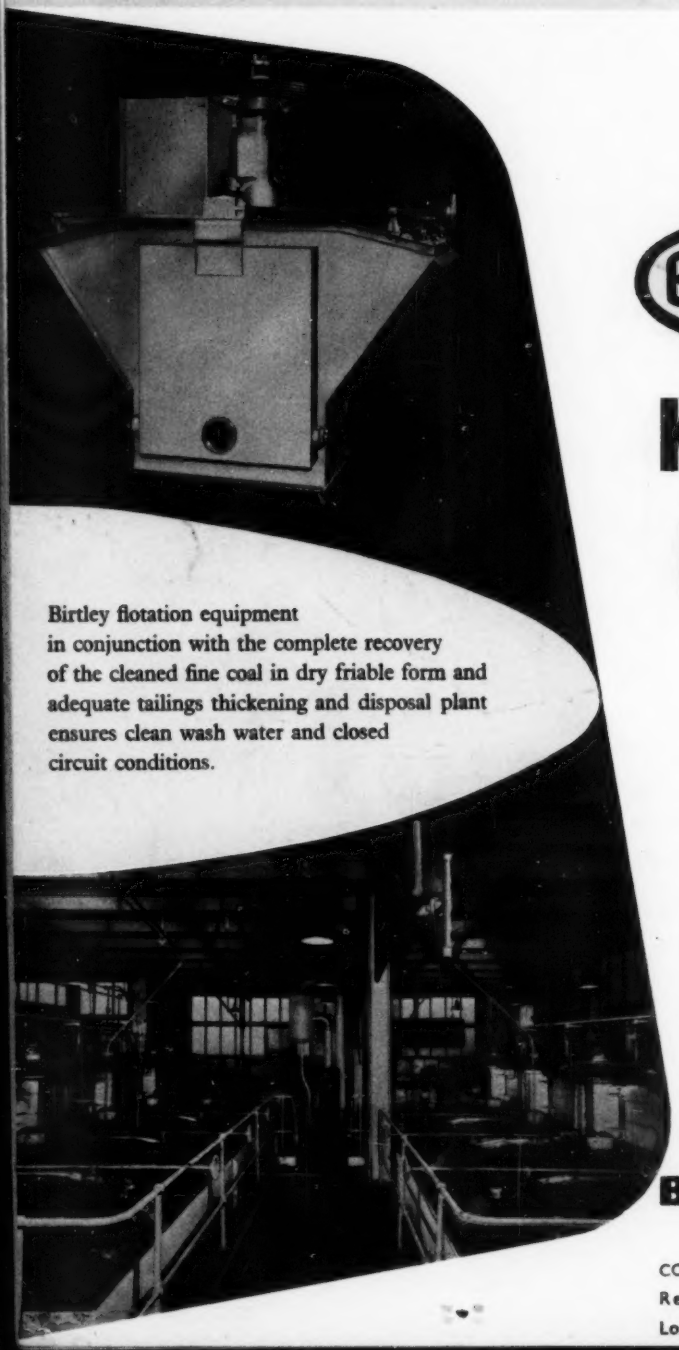

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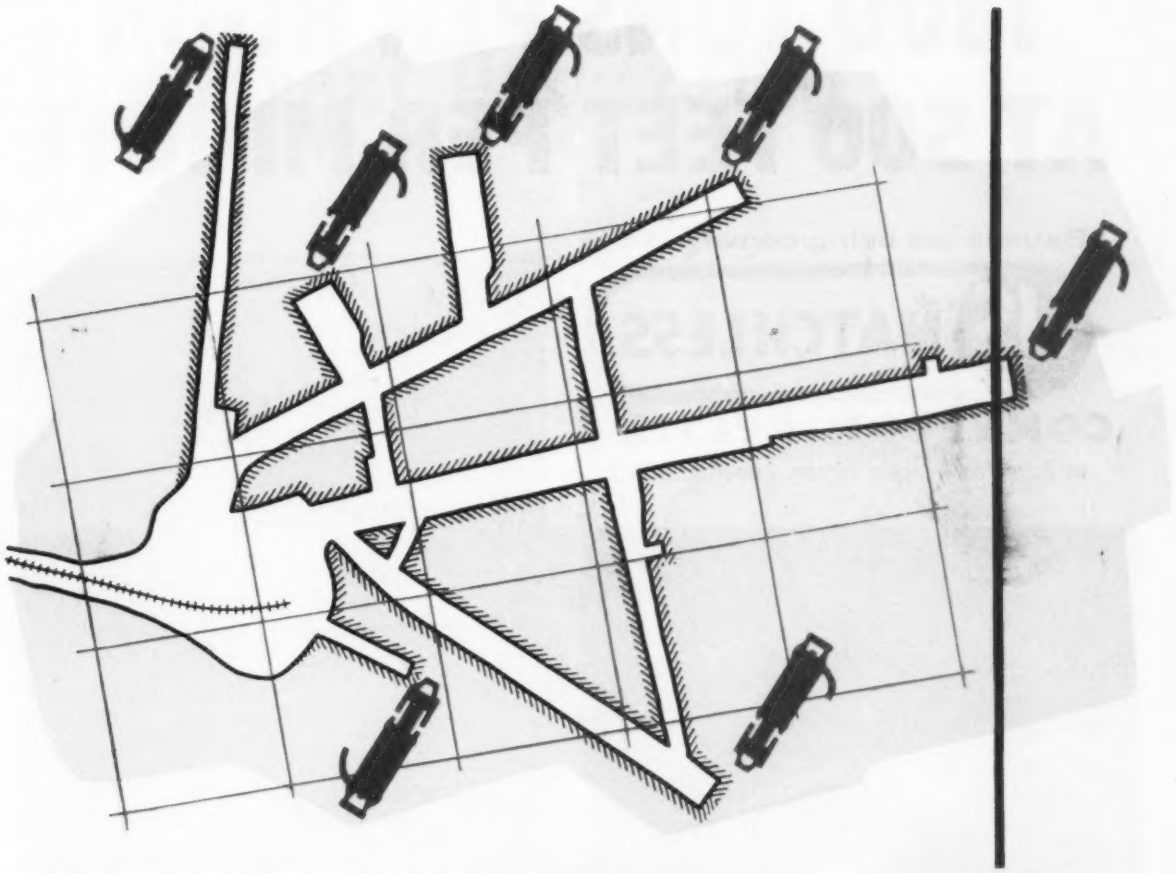

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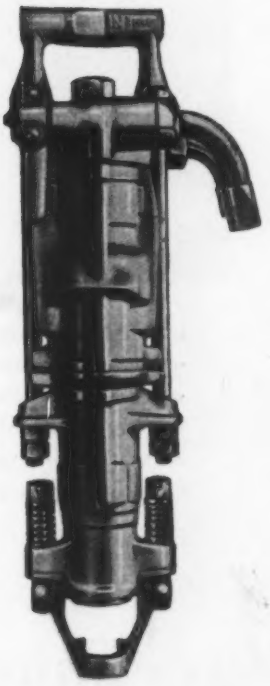

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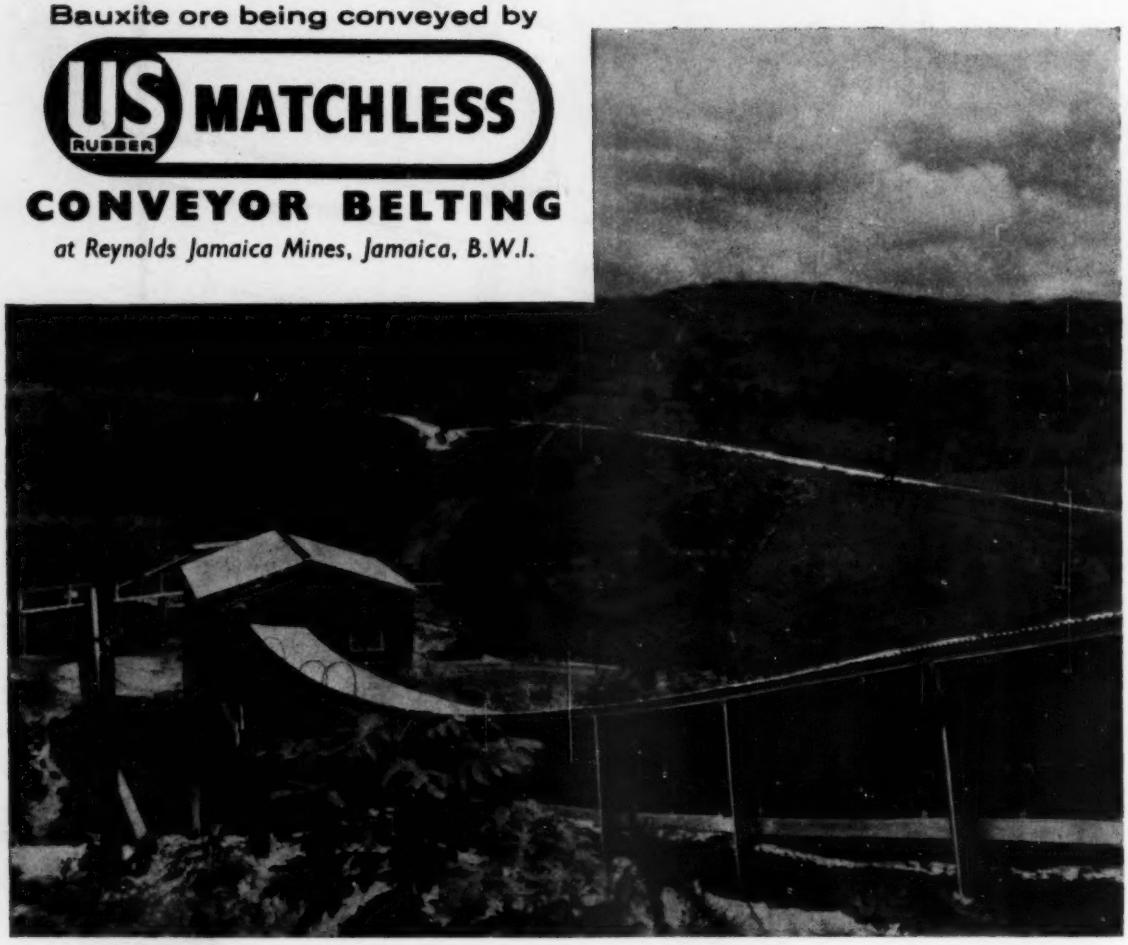

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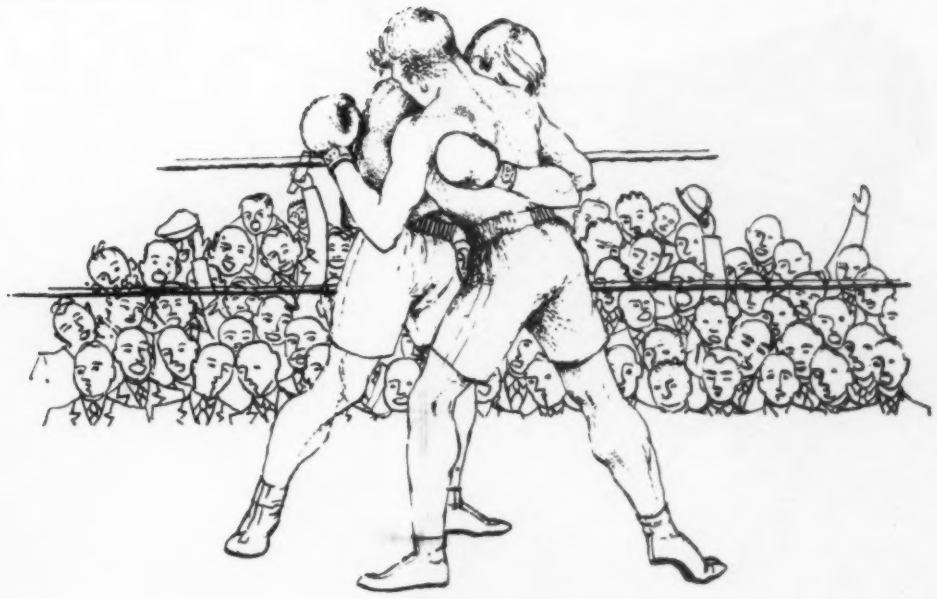

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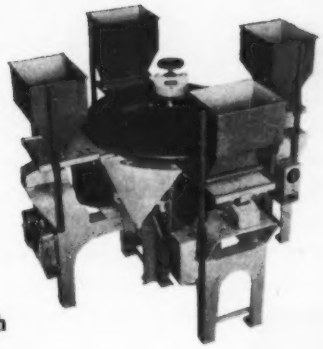

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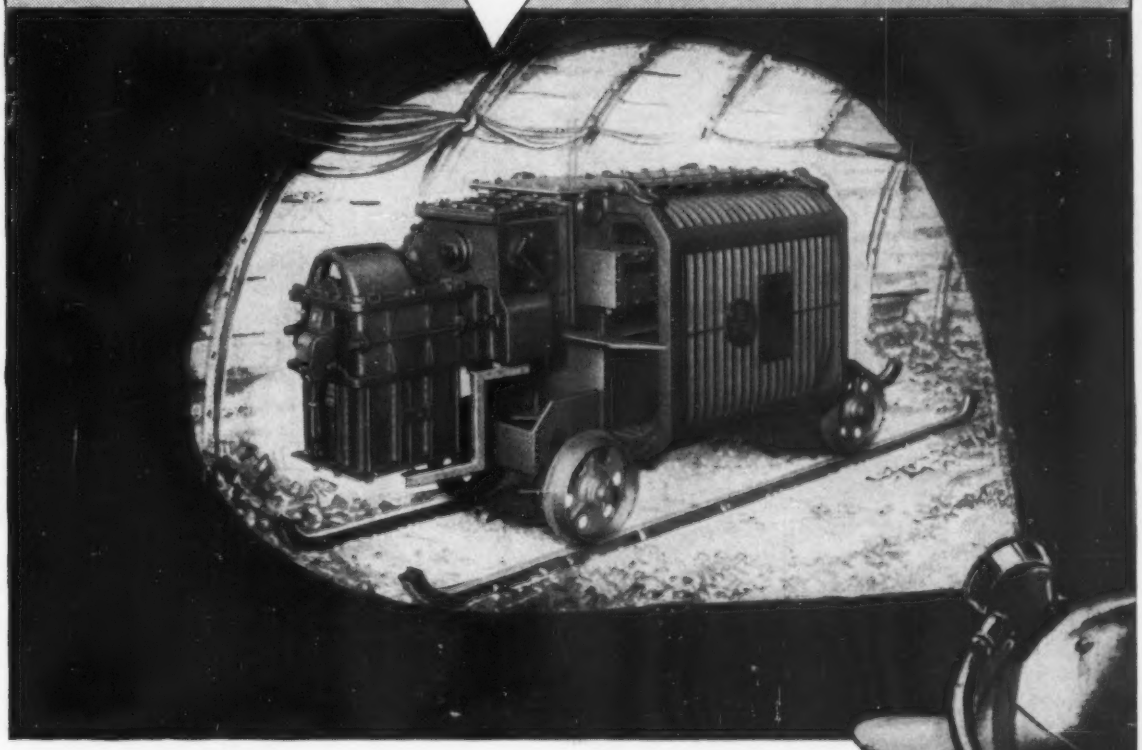

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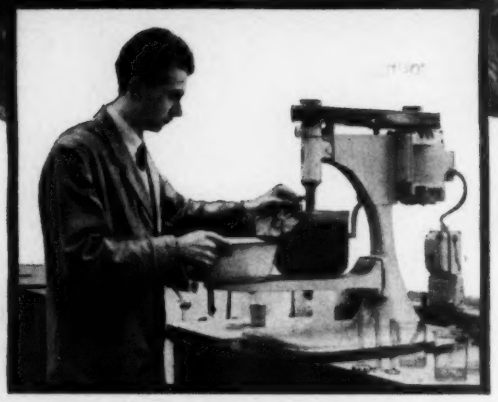

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The Mining Journal

London, March 14, 1958

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Iron Curtain in British Columbia

SOME people learn by experience, some by example, and some not at all. Politicians, whatever their race, colour or political bias, must form one of the largest articulate groups falling into the last category. Leastwise, this view holds a good deal of water when applied to the mining industry.

Nor should this remark be interpreted in a narrow context. Nationalization of the coal mining industry in this country has created more problems than it has solved and less coal, both quantitatively and qualitatively. In Bolivia nationalization is quickly and most effectively bringing its mining industry to the verge of utter ruin. Mexico is managing to achieve the same result through swingeing tax codes. And Indonesia, not to be deterred by what goes on in the New World, is just about to embark on the classic nationalist project of taking over foreign-owned mining interests.

The list can be extended. But to view the other side of the medal it ought to be noted that both Malaya and Ghana, since their declarations of independence, have enacted legislation in favour of their respective mining industries. Eire, too, can be singled out as a country which has realized the value of incentives and, having made these available, has witnessed a genuine revival of interest in the exploitation of its mineral resources.

Canada, the rugged home of free enterprise, has often been held up in these columns as pursuing an enlightened government policy towards its mining industry. And that can still be counted as roughly true. But being a Federation, provincial governments hold sway in their own Provinces. This is an important point, particularly when a change of government brings into power a party wedded to a policy, the basic economic and political tenets of which were formulated in bygone years and in other circumstances.

Such an event seems to have happened in British Columbia, Canada's westernmost Province. There, a policy of socialization of the Province's mineral resources is rapidly taking effect. While it is early days yet to give a sound judgment on the changed situation, all signs available point to the ultimate results being indistinguishable from those obtained under nationalization in any of its forms. That is to say, there has already been a steady decline in exploration and development activity.

The rot set in, as it were, in March, 1957, when the British Columbia legislature adopted two Bills designed to amend the mining laws of the Province.

The first, Bill 87, is called the Mineral Property Taxation Act and provides for an annual property tax on producing royalty-free Crown-granted mineral claims. Since the Act was passed, supplementary regulations have been approved which designate iron ore as the only mineral to be subject to the tax at the present time. Crown-granted mineral claims not subject to the Act will continue subject to the tax of 25 c. per acre under Part IV of the Taxation Act. Under the terms of Bill 87 the Provincial cabinet has the power not only to specify the mineral to be taxed and the producing area but also to increase, decrease, or abolish that area. Assessment of the minerals contained in a designated area are made by

an assessor who is given wide powers in fixing the fair value of the contained minerals.

Subsequently, all iron-producing areas on Vancouver Island, the only area to yield any quantity of iron, has been designated as a taxable area under the terms of the Act. In effect, as admitted by government representatives, the new tax is designed to stop the production and export of iron ore (all iron concentrate in B.C. is at present shipped to Japan) so that the mineral will be retained in place until a steel industry is feasible within the borders of the province.

The second, Bill 91, is entitled, "An Act to emend the Mineral Act" and abolishes the system of the Crown granting mineral claims. It substitutes instead a system of leases —the five-year lease following the holding of a claim by recording for five years, and renewable; and a production lease for 21 years and renewable where a property has been developed to the production stage. Terms of the new Bill are such that ministerial discretion will apply to the granting and renewing of the leases and intentions regarding production must be clarified before the leases are approved

Since the passage of the Bills a growing hostility has developed on the part of the mining industry towards them. The best summing up of the position created by the Bills was, perhaps, that of Mr. C. H. Mitchell, Editor of the *Western Miner*, who said that the detrimental legislation included punitive and discriminatory taxation, restriction of tenure, elimination of indefeasible title, substitution of ministerial discretion for statutory rights and what purports to be the introduction of the thoroughly discredited concept of taxation of ore in place.

Mr. Mitchell passed this comment in a panel discussion between representatives of the mining industry and the Provincial Minister of Mines, the Hon. K. W. Kiernan, which was held under the auspices of the Board of Trade. The British Columbia Government's case was put by the Minister of Mines who said that since a limited area only of the province was available for agricultural development, emphasis would have to be placed on industrial development. To assure this, he added, it was necessary to retain *in situ* all these minerals which are limited, notably iron ore, which will in time create the necessary inducement for the establishment of a steel industry in the province.

The establishment of a steel industry in British Columbia is a commendable enough objective and if British Columbia was one of Canada's chief iron ore shippers, the adoption of a policy designed to stop all exports to build up ore reserves could just about provide a basis for discussion. But the known iron ore deposits in British Columbia are small, scattered and, in the aggregate, would not be sufficient to underpin a sizeable company operation. The urgent need, therefore, is to promote exploration activity and, in a province whose rugged topography is a major obstacle to any kind of low-cost exploration technique, incentives not deterrents must be the order of the day.

Indeed, the B.C. Government's attitude can be interpreted as a vote of no confidence in the province's iron ore potential. In order, however, to have the best of both worlds, the electorate is being asked to support a policy seemingly formed by latter-day Luddites on the basis of "British Columbia's iron ore resources for British Columbians". Needless to say, the only proven method of building up ore reserves is to encourage the search for new deposits. But the application of the present discriminatory and confiscatory taxation has brought exploration to a standstill.

In some ways, the whole *affaire* can be represented as merely a storm in a teacup if, and only if, all that is involved are the small, scattered and relatively unimportant iron ore reserves in the province. But this is far from being the case. The present strictures placed on the province's iron ore mining can, by a stroke of the pen, be applied at any time to any other mineral. But even more important is the fact that geographical boundaries become blurred under the dead hand of political bureaucracy so that the moral of this note is not confined to only one province in Canada.

Indeed, as Mr. L. P. Kent in the panel discussion mentioned earlier stated, "The iron ore industry has been dealt the first blow, the balance of the mining industry can only wait in apprehension for the next". Certainly, the long-standing confidence in the equitable nature of British Columbia's mining laws, encompassing security of title and reasonable application of taxation, has been dealt a crushing blow.

"Lilies that fester smell far worse than weeds".

DOES THE U.S. WANT TO SELL MORE COPPER ?

Mr. Roy Glover's speech to the Mine-Mill Union in Denver this week, like so many of his public utterances, was challenging and controversial. With first reports of his remarks reaching us as we go to press, we can do no more than consider one point he made, which may be open to some misinterpretation by a public which has been brought to believe that the copper industry is at present suffering from a surplus of production and an even greater surplus of productive capacity.

After referring to the rapid growth of European copper consumption over the past two years and to the fact that Anaconda have already placed their entire output of copper from their *planned* production for 1958, he went on, according to *Reuter*, to say: "The principal function of our sales organization has been to explain to our European customers, and others who wish to become customers, why it is not possible for us to deliver to them additional 1958 copper. The answer", he says, "is, of course, simple. The present price does not justify the production of available higher-cost copper".

Mr. Glover is, of course, referring only to the circumstances of his own company, but even so the fact that Anaconda is working below capacity serves only to underline the fact that whatever may be the state of individual order books, the American producers and smelters collectively have large surplus stocks.

If Europe is tight for copper today, it is because there is no inducement for Americans to ship more copper across the Atlantic than they can help, while the L.M.E. price is so far below the U.S. producers' fixed price. If the European shortage of spot metal gets sufficiently acute, the L.M.E. price will presumably rise to a level at which the American producers will be able to off-load some of their surplus at their own price.

Meanwhile, the rigidity of their pricing system seems once again to be causing the Americans unneccessary embarrassment. Early in 1956 they eventually realized that the only way to bring down the L.M.E. price from the absurd heights to which it had been forced, was to sell at the market. Once they did this, the results were immediate. Equally today, it may very well be that the quickest way to achieve a more balanced re-distribution of world stocks would be for American producers once again to sell at the L.M.E. price.

This, of course, presupposes that they wish to run down stocks at this juncture. If, in fact, they regard their accumulated stocks as in the nature of an informal buffer stock aimed at price stabilization, this intention would have more effect on the market, if it were publicly stated.

Washington is hardly likely to invoke the anti-trust laws in the present state of the American economy.

ASIA LOOKS TO HER MINERALS

The recent meeting in Kuala Lumpur, Malaya, of the ECAFE Committee on Industry and National Resources provided an excellent forum for the Malayan delegation to raise the question of how the country's abundant iron ore, low-grade coal, lignite and ilmenite may be used to the best advantage.

Mr. J. H. Harris, Chief Research Officer of the Research Division of the Malayan Department of Mines, speaking on the Sub-Committee's Report on Iron and Steel, pointed out that the declining use of Malayan coal for fuel invited consideration of its employment for other purposes. It was not coking coal, but as pilot plants for producing iron without coking coal had been set up in India and in the Philippines, he thought it should be possible to introduce a similar scheme in Malaya by which Malayan iron ores could be smelted with the use of Malayan low-grade coal and lignite. Taking this point to its logical conclusion, Mr. Harris stressed that the greater utilization of indigenous coal resources held out the hope of recovering other by-products and would, perhaps, result in the manufacture of fertilizers.

At present, Malaya exports large quantities of iron ore to Japan for the smelting of which coal is imported from the United States. The advantage to Japan, therefore, if it were possible for Malaya to export the smelted iron ore, was obvious. On this point, however, the Japanese delegate would go no further than stating that his country would be willing to give all possible help.

Mr. Harris also wanted to see a greater utilization of the locally produced ilmenite. Modern electrical smelting methods made it possible to extract from this mineral pig iron and a titanium-bearing slag which was acceptable to the manufacturers of titanium oxide pigment.

In a wider context the ECAFE Committee approved a resolution calling for the making of an Asian and Far East regional geological map on a scale of 1 : 5,000,000, the cost to be met by contributions from the countries concerned. Such a plan, it was argued, would provide the essential basic data from which surveys could be taken to discover what and where the potentially economic resources of the region were located. Other important resolutions included proposals to stimulate trade in minerals, reduce freight charges, and improve transportation facilities among Asian countries.

U.K. MINING MANUFACTURERS—R.S.V.P.

Recent legislation passed by the Argentine Government authorizes the National University of Tucuman to explore and exploit mineral deposits in the province of Catamarca, and simultaneously creates an institution named Yacimientos Minerales de la Universidad Nacional de Tucuman. Exploitation is projected immediately.

The deposits, 35 km. to the east of a small town named Hualfin, reveal manganese in conjunction with gold and a smaller proportion of silver over a wide area. As an example of the potential of the district, it is reported that one single seam has been established extending for 15 km. to an estimated depth of 200 m. and with a width of several metres. The estimated ore content exceeds 300,000 tons valued at well over £2,000,000. The future would appear to be bright, as the steel plant under construction at San Nicolas has already made firm bids for large supplies of manganese.

A 90 per cent extraction of gold has been achieved from these ores, but as yet only a 50 per cent yield of manganese has been recovered. Yet despite the fact that technical advice on the most efficient methods of treating the complex ores is currently available from the United Nations representatives on the spot, the University is proceeding with plans for exploitation before a U.N. report is finally submitted.

Because of this eagerness, the University Institution is interested to know whether any U.K. manufacturers would be prepared to supply the plant necessary to exploit the Hualfin minerals.

In so far as methods are concerned, cyanidation is suggested for gold recovery while at the same time a 90 per cent reduction of manganese is desired, the Institution being open to suggestions as to the most suitable machinery necessary for this latter task. An initial manganese production of between 500 and 1,000 tons per day is envisaged. The project is certainly regarded in Argentina as one of vast possibility, and the manufacturers supplying the equipment first installed would undoubtedly enjoy bright prospects of being called upon to supply further machines of the same type. The initial plant is envisaged as costing something like $1,000,000.

The method of paying for the machinery is apparently not yet clarified, but it is clear that the University will not contemplate a concession; the necessary equipment is to be provided and installed complete, and is to be delivered in running order. Although normally the supply of such equipment would have to be put out to public tender, it is thought that permission for direct purchase would be given if an outstanding offer were presented.

Interested suppliers are advised to send their offers direct to Dr. Gutierrez, Universidad Nacional de Tucuman, San Miguel de Tucuman, Argentina, copying their initial correspondence to the Commercial Department, British Embassy, Sarmiento 443, Buenos Aires. The Export Services Branch of the Board of Trade would be interested to hear from any manufacturers proposing to follow up this project.

NEW NICKEL ELECTRO-REFINING PROCESS

Research scientists and engineers of The International Nickel Co. of Canada, Ltd., have developed a new process for the electro-refining of nickel. The new method, developed after seven years of continuous study, is described as a major achievement in chemical metallurgy.

A main feature of the process is the direct electrolysis of nickel matte, and artificial sulphide. This contrasts with the usual electro-refining methods, including those employed in the nickel industry, in which a metal anode is used. The new Inco process eliminates high-temperature oxidation and reduction operations, with attendant losses of metals and sulphur and selenium. Instead, nickel sulphide of low copper content from the Bessemer converter or other source can be cast directly into sulphide anodes and electrolyzed for the production of high-quality nickel. Another unique feature of the process is that it permits, for the first time in nickel refining, the commercial recovery of elemental sulphur and selenium as valuable by-products, in addition to cobalt and precious metals conventionally recovered.

The new process is claimed as more efficient than the company's present practice. Inco recovers 14 elements from the ore it mines.

The new process, for which Canadian and United States patents are pending, is in commercial operation in a section of the company's Port Colborne nickel refinery in Ontario.

Sulphuric Acid and the Mining Industry

Sulphuric acid is of such very great importance to nearly every industry that variation in the level of acid production has long been accepted as a barometer of economic and industrial vitality. The mining industry is intimately associated with the production of sulphuric acid, large quantities being obtained as a by-product in the smelting of sulphide ores. A further raw material for sulphuric acid manufacture is iron pyrites. Pyrites concentrates are commonly produced in the flotation plants of base-metal mines, but there are also important mining operations conducted solely for the production of pyrite for acid manufacture. Sulphur produced by the Frasch process and, in the U.K., anhydrite, are two other raw materials for sulphuric acid manufacture which fall within the province of the mineral industry.

WITH the inception of the uranium production programme of Britain and America the mining industry represented by the numerous Commonwealth uranium operations became a sulphuric acid consumer on a large scale. The leaching of South African uranium ores requires on the average 30 lb. of sulphuric acid per ton of ore treated (the leaching of some uranium ores consumes much greater quantities of acid per ton), and the uranium industry in South Africa consumes some 1,500 tons of acid daily.

Overall, the production of uranium concentrates in the Western World (after allowing for plants operating on alkali-leach process) must be consuming over 750,000 tons of sulphuric acid a year. Important sections of the mining industry are, therefore, closely connected with acid manufacture, both as producers of raw materials for sulphuric acid manufacture and as large acid consumers.

As the use of brimstone to make acid means to most countries the dollar importation of this material, there has been a significant trend towards the use of local materials by sterling area countries, that is, towards the use of pyrites or sinter gases from the treatment of sulphide ores. Thus Australia in 1949 produced over 60 per cent of her sulphuric acid from imported brimstone. Since that time total production has been increasing but, encouraged by a bounty paid by the Australian Tariff Board on acid produced from pyrites, the proportion of acid produced from local materials has risen and will, it is hoped, exceed 65 per cent, relegating brimstone to the less important source of acid in that country.

Brimstone v. Pyrites

To produce a ton of sulphuric acid requires 0.35 tons of brimstone or approximately 0.75 tons of pyrites. The landed duty-free cost of brimstone in Australia is about £A20 10s. per ton. At this price a bounty of £A2 is paid on each ton of acid made from pyrites. Were the costs of producing sulphuric acid from pyrites the same as in the case of acid produced from sulphur, Australian acid manufacturers could afford to pay about £A24 10s. per ton of sulphur content in pyrites concentrates. In practice, however, heavy conversion costs must be added to the cost of producing acid from pyrites and these may be of the order of £A10 per ton of sulphur equivalent, reducing the economic price of sulphur in pyrites to a figure of the order of £A14 per ton. At the Norseman Gold Mines N.L. plant on the Iron King mine in West Australia, equipped at a cost of £A700,000, the cost of pyrites was expected to fall to £A15 per ton sulphur content when the mine was producing the equivalent of 40,000 tons of elemental sulphur per year. This price f.o.r. Norseman W.A. could not be competitive with American sulphur.

Omitting the cost of pyrites and brimstone, the operating costs of acid plants using sulphur from pyrites is also higher than the net production cost when using brimstone. The capital cost of acid plant to use pyrites is also higher than acid plants utilizing brimstone. The cost of chamber and contact plants using brimstone in the U.K. is stated to be about £11 per ton-year of sulphuric acid capacity whilst chamber or contact plants to use pyrites may have a capital cost as high as £22 per ton-year capacity. However, the capital cost of contact acid plants built in South Africa in connection with the uranium production programme which utilize pyrites from the mines, are reported to have been between £10 and £12 per ton of H_2SO_4 per year and similar capital costs have obtained with recent European installations.

South African Pyrites Production

West Rand Consolidated Mines has recovered pyrites in the gold milling plant for over 25 years and at the inception of the uranium programme was producing 90 tons per day for sulphuric acid manufacture. The pyrite recovered from Witwatersrand gold ores is in finely divided form and to use this material satisfactorily in producing acid, fluidized bed roasting was adopted in the South African acid plants. The roasters employed in South Africa are of the Dorr Fluo-solids type and have various internal diameters between 14 and 24 ft.

As finally completed, the uranium extraction programme in South Africa included eight acid plants, seven of which were constructed by the Chemical Construction Co. of New York and one, at Blyvooruitzicht, by Simon-Carves Ltd. All include Fluo-solids roasters in the flowsheet.

The production cost of sulphuric acid in the Reef plants is of the order of £3 10s. to £5 per ton of acid. These costs are exceptionally low mainly on account of the low cost of producing pyrites at the mines.

The salient details of the Union acid plants show a total capacity of 1,550 tons per day :

Location	*Starting Date*	*Capacity Tons/day*	*Fluo-Solids Roasters*
West Rand Consolidated ...	Oct., 1952	50	2
Daggafontein ...	March, 1953	220	3
Western Reefs ...	Sept., 1953	220	3
Randfontein Estates	Feb., 1954	220	3
Virginia	Jan., 1955	370	3
Stilfontein	Oct., 1955	220	3
Blyvooruitzicht ...	Oct., 1956	150	2
Buffelsfontein ...	July, 1957	100	1

European acid plants utilizing pyrites import fairly large quantities from Cyprus and elsewhere at low prices. Overall, however, pyrites sold on a basis of 48 per cent to 50 per cent sulphur content probably fetches about £5 per ton at the mine and often costs the consumer nearer £10 per ton by the time it reaches the acid plant.

Some sulphur-burning contact acid plants have been erected on uranium mines in Australia whilst the production of the Radium Hill Mine is acid-leached at Port Pirie in South Australia where Broken Hill Associated Smelters operate a special acid plant for this purpose, utilizing sinter gases from the lead smelter.

The Ingredients of Australian Steel

THE greatly expanding demand for iron and steel in Australia is causing intensified search for new iron ore deposits. In this search The Broken Hill Proprietary Co. is active in the Northern Territory and the far north of Queensland. Extensive deposits are being examined, but it is believed that these are of lower grade than the deposits now being worked by that company in the Middleback Ranges, South Australia, and at Cockatoo Island, Western Australia.

The States of South Australia and Tasmania have been pressing a policy of State-owned steel industries; the former has been drilling in the Middleback Ranges, outside the holdings of The Broken Hill Proprietary Co. and is unwilling to grant leases to private individuals or companies. There are strong doubts as to the possibility of proving sufficient ore—and in scattered occurrences—to make a new industry feasible. Diamond drilling is being done in Tasmania, in the Savage River country, with the objective of a State industry, but there is much doubt as to the proving of adequate reserves; certain of the State's ore occurrences are unsuited for the production of iron.

To meet the demand for ore The Broken Hill Proprietary Co. is opening up the Iron Baron deposit in the Middleback Ranges, South Australia. This deposit is 30 miles from the port and smelter of Whyalla. The mine is to be mechanized at a cost said to be £A1,250,000. Power lines and a new line of railways have been constructed. Primary and secondary crushing and conveyor belt systems are being erected. The output planned is 2,000,000 tons of ore per year, to be increased ultimately to 3,000,000 tons per year. Reserves of high-grade haematite are not great, comparatively, but it is believed that drilling at the Iron Monarch mine, further north, has shown substantial extension of ore at depth, below what was previously considered the bottom of the deposit. The region contains very large quantities of taconite and the company has commenced research into its utilization. Broadly speaking, Australia's reserves of iron ore are not great, particularly those of high-grade ore.

Australia has been regarded as deficient in reserves of manganese and chrome ore. Shortage has been particularly evident in the case of chrome. In order to build up reserves of manganese ore and to stimulate prospecting for the mineral, the Commonwealth Government has been encouraging the search by permitting a proportion of the ore located to be exported. As a result of this policy, reserves are stated to have been increased to 744,450 tons, the tonnage available prior to the granting of this concession being 545,700 tons.

With the steel industry operating at its present scale, this reserve would have been exhausted by the middle 1960's, and reliance would have had to be placed on imported ore. As the result of the government policy, reserves have been increased by 139,550 tons through the efforts of the companies and syndicates interested, at the expense of the export of 16,676 tons of ore, valued at £A345,000.

Despite the great advances by alternative fuels, black coal mining continues to hold its own, with a slight increase in production. Mechanization and increased efficiency are reducing costs to some extent, and coal washing is an important factor for the future. The benefits which have been slowly built up to help the status of the industry seem likely to be nullified by the proposed demand by the miners for a 35-hr. week in place of the existing 40-hr.

In 1957, export of New South Wales coal had been increased to a level greater than for the past 30 years, and three times higher than in 1956. The tonnage exported was 765,000 tons, but this must be increased to give the desired stability to the industry. Five collieries have formed an export group; each will handle its own local sales, but by banding together they can tender jointly for the supply of coal to overseas consumers, and can thus make up worthwhile consignments.

The position will be helped by the mining of high-grade coal in the Greta seam, now workable to a greater extent by the withdrawal of the miners' embargo on the mechanical working of pillar coal. Reserves tied up through the miners' policy total over 200,000,000 tons of some of the best coal in the country. Sales, local and overseas, will be helped by the extension of the coal-washing policy, which is countering the increase in ash content resulting from mechanical mining, and there is a growing policy for the delivery of size and graded coal to suit the requirements of individual consumers. The brightening future for coal is, however, seriously threatened by the demand for the 35-hr. week.

Iron Mining in Venezuela

ONE of the most complicated and difficult ways of mining iron ore is presently experienced in Venezuela, though as much as 10 per cent of the iron ore smelted in the U.S. is the Venezuelan ore mined in the Orinoco valley jungle area.

Approximately 1 cu. ft. of clay overburden has to be removed for every 1 cu. ft. of iron ore that is loaded in an open pit location. The problem of clay overburden is substantially increased because of the extremely damp climate.

The task of removing the clay overburden and loading out the iron ore is carried on by three Marion 4161 shovels. The machines load ore with an average output of 4,500 tons per 7½-hr. shift. Each of the three shovels, which are powered by robust blower-equipped motors, has a 5-yd. dipper capacity. The mined ore is loaded into Euclid trucks with side dump trailers. Each loaded Euclid has to make a 1¼-mile haul from the pit location in order to reach the crushers. The crushed ore is hauled by an 8,000-ton capacity ore boat from the crusher site on the bank of the Orinoco river to the nearest coastal port.

A Marion type shovel loading ore with an average output of 4,500 tons in a 7½-hr. shift. The shovel has a 5-yd. dipper capacity. 1 cu. ft. of clay overburden has to be removed for every 1 cu. ft. of ore loaded in this open pit on the fringe of the Orinoco valley jungle

CONVEYORS—II

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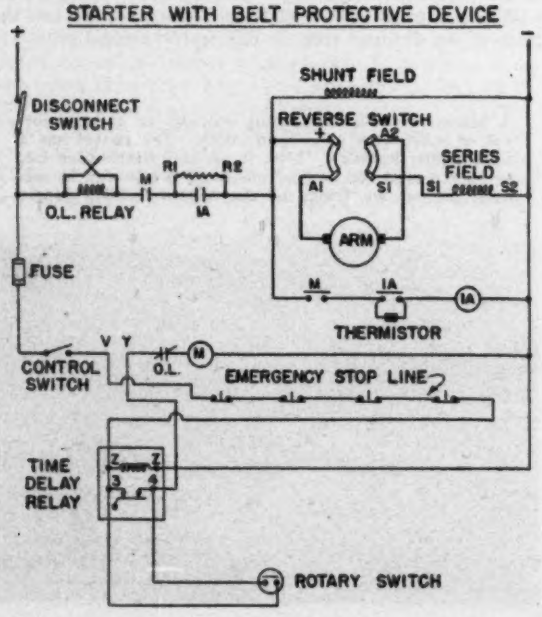
One very simple arrangement accomplishes this purpose by using a rotary switch and a small timing relay in conjunction with the magnetic starter of the motor.

The rotary switch is similar to the one used in sequence-starting except that it has normally open contacts which must close for both forward and reverse direction of the belt, the switch is driven by its own belt, and it is located at the head-end near the controller and motor.

The illustration shows the simplified wiring of the controller with the belt protective device added to the control circuit. Referring to the diagram, all of the emergency stop switches should, of course, be closed. Then when the control switch is closed to start the motor, current flows through coil ZZ of the timing relay to the negative line thus starting the timing cycle.

Current also flows through the normally closed contacts of the timing relay, through the emergency stop switches, the overload trip O.L. and the operating coil M of the main line contactor. The motor starts and accelerates in the usual manner to full speed.

When the belt reaches a definite speed the rotary switch contacts close and short-circuit the timing relay contacts so that they can now be opened without stopping the motor. These contacts then open after the elapsing of the timing period, 2 to 5 sec., for which the timing relay is set. If the belt should stop because of a broken splice, failure of tension device, jamming of coal between roof and belt, etc., the rotary switch contacts open and stop the motor.



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Two-Speed Belt Conveyor

Many States have safety laws which limit the belt speed to 200 or 250 f.p.m. when carrying men or supplies. The electrical control can be arranged to give this slow speed when carrying men or supplies and twice the speed when carrying coal.

Two-speed belt conveyors also find an application where shuttle cars unload directly on the belt. High speed is desirable so that the shuttle car can unload quickly. Low speed is used when the belt is not carrying coal to save wear and tear on the belting, rollers and bearings. A push-button station or lever-operated switch is usually provided at the loading station so that the shuttle car operator can control the speeding up of the belt.

There are three methods generally used to obtain two-speed control. The first two are by far the cheapest but are limited in application. The third method fits all applications.

The first method consists simply of inserting a resistor of proper ohms and capacity in series with the armature circuit for slow speed. The resistor, of course, reduces the voltage across the armature and consequently the speed. For high speed the resistor is short-circuited by a knife-switch.

This simple and inexpensive arrangement is satisfactory for half speed when men or supplies only are carried on the belt. The ohms and capacity of the resistor are designed for this light duty. If coal is carried at the slow speed the increased load would further reduce the armature voltage and slow the belt speed considerably as well as overheat the resistor. Consequently, this method is recommended for carrying men and supplies only at the half speed.

The second method utilizes a two-speed gear transmission between motor and speed reducer. Gearing is totally enclosed and runs in an oil bath. A flexible coupling is part of the transmission. The handle is thrown in one direction for half speed and in the other for high speed. The motor must be at rest before a change from one speed to the other is made.

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Examples of application using these basic ideas are systems using—belts or cars for main haulage, chain conveyors for room and cross conveyors, continuous miners such as the Colmol with either a bridge conveyor or a Moleveyor.

The ultimate mining operation would be a mine completely automated. Human personnel would be used only to monitor the system to assure that all components were functioning properly. Such a system is not just an idle dream. Semi-continuous-remote controlled mining systems have been operated near Kitanning, Pennsylvania, and one is operating near Charleston, West Virginia.

Before such an automated mine can be operated, there are problems that must be overcome, such as improving components of equipment so that mechanical failures are reduced to a minimum, so that machines will run more nearly 90 per cent of the time instead of the current 50 per cent; designing equipment that will operate under all types of roof and bottom encountered in mining conditions and equipment that will mine all types of coal and rock and other inclusions; improved communications between operating personnel and equipment manufacturers so that proper corrective measures are taken to eliminate electrical and mechanical difficulties; and more planned preventive maintenance programmes so that lubrication is properly done and so that units are replaced before complete failure has occurred.

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The Department of Mines estimates the value of mineral production in 1957 at approximately £5,460,000. An increase in diamond exports offset reduced exports of lead concentrates and gold bullion, and the total value of exports is expected to be approximately £5,045,500—about the same as in 1956. A slight fall in the value of minerals consumed within the territory is recorded. It is emphasized that the 1957 figures are provisional.

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Production of rough diamonds from both Williamson Diamonds Ltd. and Alamasi Ltd. exceeded that for 1956. Exports showed an increase of approximately 4 per cent by weight and 1½ per cent by value.

At Williamson Diamonds Ltd. the original pilot extraction plant was converted for use in bulk sampling and the new recovery plant operated with a high degree of efficiency. At Alamasi the erection of a new bulk sampling plant was begun and improvements were made to the main treatment plant. A 1 cu. yd. dragline was brought into use. The output from this mine showed a considerable increase above the average for recent years.

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Heavy rainfall on the Chunya goldfield early in the year handicapped the few remaining producers, and exports of bullion from this field declined to 4,315 oz. The alluvial output increased to 923 oz. from 61 diggers. A little gold was produced at Sekenke and Kirondatal in Singida District. Gold and silver obtained from the lead concentrates of the Mpanda mine will show some reduction this year due to reduced output from that mine.

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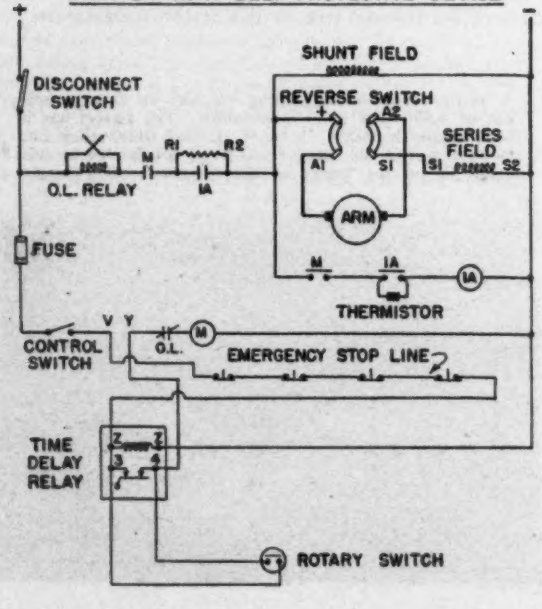

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At the Mbeya pyrochlore deposits of the Mbeya Exploration Co. Ltd., the 150 tons per day pilot mill came into operation to provide information for the design of a final production mill capable of treating several thousands of tons of ore daily. A large stockpile of ore was accumulated for the new pilot mill. Exploration by means of adits and diamond drilling continued. Metallurgical tests indicate that Mbeya pyrochlore can be converted without undue difficulty into high-grade metal.

Other Minerals

The difficulties of the smallworkers on the Karagwe tinfield, caused by the closing of the tin buying post at Kikagati, were removed when the British Metal Corporation Ltd. re-opened the post in February. About 20 tons of concentrates were produced. Work on the 1,000 ton per day mill at Kyerwa went on continuously. Due to the low price of tungsten, there was no production of wolfram in this area.

Interest was shown in the small surface copper showings at various places, in the nickel-bearing occurrences at Haneti, north of Dodoma, and in that at Kungwe Bay, near Lake Tanganyika. Further drilling was carried out by the Geological Survey Department on the Liganga iron deposits.

The East African office of the U.K. Atomic Energy Authority was opened at Dodoma during the year to encourage the search for radioactive minerals. Among the various tasks undertaken by this Authority during the year was an examination of certain hot springs for helium, the occurrence of which had already been recorded by the Department of Geological Survey.

The weight of gypsum exported for use in the cement industries in Kenya and Uganda was 9,510 tons. The Ilima mine in Tukuya District produced 1,331 tons of coal during the year—apparently sufficient to satisfy the present local market. The Tanganyika Meerschaum Corporation continued their active examination of the deposits on the Kenya border and mechanized mining by the introduction of pneumatic picks and mechanical loading and transport in the opencasts. There was a small export of magnesite; bentonitic clays associated with the magnesite deposits also received attention. A company was formed to exploit the garnet deposits at Namaputa in Masasi District and trial shipments were made. The quality of the garnet is known to compare well with standard commercial grades.

The extensive aerial prospecting operations, which were such an outstanding feature of 1956, gave rise in 1957 to much detailed prospecting on the ground. The Western Rift Exploration Co. Ltd., with an authorized capital of £1,000,000, took over the special exclusive prospecting licence of 34,000 sq. miles granted to Anglo American Prospecting Co. (Africa) Ltd., which remains in charge of the operations. More staff were engaged and the company's headquarters in Chunya was considerably expanded. Field work included examination of the western part of the Chunya District, the basic intrusive at Kungwe Bay on the shore of Lake Tanganyika, copper mineralization in the Sango-Karema area, and the Ngualla carbonatite.

New Consolidated Goldfields Ltd., which had been granted seven special exclusive prospecting licences aggregating 664 sq. miles, surrendered that at Luiche in Kigoma District, when the source of radioactivity was found to be uneconomic; however, interesting mineralization has been found in their Northern Province areas, and also at Wigu Hill in Morogoro District where the existence of monazite and rare earth minerals has been confirmed. Copper-gold mineralization near Mara was also examined under a licence covering 42 sq. miles.

Geological work and drilling undertaken by Williamson Exploration Ltd., a subsidiary of Williamson Diamonds Ltd., on three special exclusive prospecting licences totalling 918 sq. miles, resulted in the surrender of one on which ground work revealed nothing of economic interest. Work on the other two continues. A fourth licence was granted over 184 sq. miles in Singida District.

The Colonial Development Corporation completed its investigation of the Kivira-Songwe coalfield near the northern area of Lake Nyasa; a coal mining lease was applied for.

In the face of rising production costs, the fixed price of gold and the depressed price of base metals are matters for concern everywhere, especially to small producers and individual prospectors. The larger companies, however, are pressing ahead with their prospecting programmes. Progress at the Mbeya pyrochlore deposit, at the Kiabakari gold mine and at the Kyerwa tin mine, augur well for the coming year, but diamonds are likely to remain the mainstay of the country's mineral exports for some time yet.

The Nigerian Coal Corporation

IN common with most underdeveloped countreis, Nigeria is striving hard to boost its mineral production. If living standards are to rise, so then must energy consumption, and this necessitates greater availability of fuel. Although operations are not mechanized to anything approaching the extent found in Western coalfields, great strides have been made to increase productivity in the Nigerian coal industry.

A record output of 790,029 tons is reported by the Nigerian Coal Corporation in its review of the year ended March 31, 1957. Coal exports during the year amounted to 70,567 tons, the bulk of which was supplied to Ghana Railways.

Obwetti Mine produced 404,695 tons, being an increase of 43,062 tons compared with the previous year. This mine generally is in good condition, but the south side is approaching the outcrop and decreased output is foreseen.

Iva Mine produced an output of 251,004 tons, exceeding the previous year's output by 4,053 tons. A reconstruction and development scheme at this mine is practically completed and output for the next year was expected to show a considerable improvement.

Hayes Mine continues to develop according to plan, although an unworkable area of thin coal has been struck, thus reducing the available reserve on the south side by approximately 123,000 tons. Due to trouble experienced with the thin coal, the annual output declined by 9,900 tons. Water intake continues to increase as further pillars of coal are extracted. Completion of a new water drift under construction should give gravity drainage to all the water on the east and south sides, but a centralized pumping plant will eventually be required for the north side.

Work is going vigorously ahead on the new Ekulu Mine, which is planned to go into full operation in 1960. In May, 1956, a start was made on the two main drifts planned to develop this area, both of which have proved a coal thickness of 5 ft. 6 in. Temporary plant has been erected for disposal of the dirt and coal. Diesel and electric locomotives are on order, as well as an aerial ropeway of 150 t.h.p. capacity to transport coal from Ekulu to the Iva sidings.

The Federal Government, having imposed a royalty upon coal produced (other than export coal), the net charge of 4s. per ton was passed on to customers by raising the pithead selling price to 50s. per ton.

Machinery and Equipment

Sensitive Geiger Counter for Rough Work

Features of a new lightweight geiger counter, introduced by Radiation Monitors Ltd., are its simplicity of design, high sensitivity, visual and audible indicators, and an extremely long life of batteries.

The new unit, produced under licence from the U.K.A.E.A., utilizes a halogen-quenched tube of 6¼ in. effective length in a simple integrator circuit, using no valves or transistors. The tube rides in shock-absorbent mountings, and the whole unit, together with the batteries and loudspeaker, is housed in a high-impact plastic case capable of withstanding rough usage. It may be operated with the hand-grip or carried over the shoulder by a sling. High-tension power supply is derived from a pack of internationally available 30-v. layer-type batteries.

Three ranges of operation are available. When not in use, the instrument idles at a high range. A medium range is provided, but for most applications a low range is used, one switch being sited at the top of the case and two on the front of the hand-grip. A socket is provided for a miniature crystal earpiece which can be supplied as an extra. The socket may also accommodate a plug for connecting the instrument to a further metering and recording device, the output being sufficient to operate these direct.

Due to the extremely low current consumption—of the order of a fraction of a microamp at background level—the life of the batteries in the continuously operating circuit far exceeds the shelf life claimed by the manufacturers.

As a guide to the sensitivity of this unit, typical background counts over chalk areas are from 40 to 50 counts per minute, whilst over West of England granite, away from metalliferous areas, counts range from 110 to 180 per minute according to locality.

Designed primarily for the detection of radioactivity and rough mapping, however, and not for its precise measurement, this new unit is a robust tool with a wide range of applications from reconnaissance surveying and prospecting to routine industrial monitoring where radioactive materials are used. Simplicity of design and construction have permitted the marketing of this tool at a fraction of the price of existing counters: a step which materially widens its range of application.

CONVEYOR BELTS—MATERIAL AND P.V.C.

Turner Bros. Asbestos Co., a member of the Turner and Newall Organization, and the largest asbestos manufacturing enterprise in the world, held a Press reception last week to mark the opening of a new factory, designated South Block, which completes the £4,000,000 development project started by the company at Hindley Green, near Wigan, Lancashire, in 1947.

The Hindley Green factory as a whole now occupies a site of some 140 acres, and can be divided into two distinct factory blocks, North Block and South Block.

The North Block was completed in 1949, and is devoted to the manufacture of power transmission and conveyor belting. The South Block, the foundations of which were laid in January, 1954, is now engaged in the manufacture of various asbestos textiles, mainly brake-lining materials, a large proportion of which are supplied to Ferodo Ltd., an associated company (*vide The Mining Journal*, March 22, 1957). Glass textiles and resinated asbestos moulding materials will also be produced in this block.

Of particular interest to members of the technical mining Press were the processes constituting the construction of conveyor belts—both natural and P.V.C. Turner Bros.'s natural-rubber belts are widely used in quarries, while their P.V.C. belts are supplied in large quantities to the National Coal Board.

SYNCHRONIZED AIR MOTORS

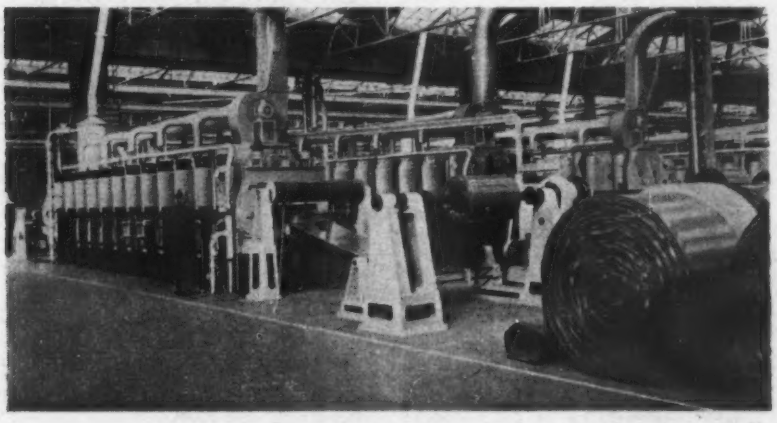
A method of providing simultaneous control of the compressed-air driving motors at each end of a face conveyor has been used with success at Haig Colliery, Cumberland.

A control panel is fitted at each end of the conveyor. Separate air supply mains are provided for each motor, and the controls at each end of the face are operated by levers which actuate a control valve connected to the main air supply. The throttle valve of each motor is operated through a link mechanism by a piston moving vertically in a cylinder. Movement of the valve is achieved by admitting compressed air into the cylinder, either above or below the piston, through the operation of the control lever.

The control valve also regulates the supply of air to two pilot control tubes, each ¼ in. in dia., laid along the face and connecting respectively with the top and bottom of the cylinder, controlling the throttle valve in each control panel. Thus operation of the control lever at one end of the coal-face introduces compressed air into the control cylinders of the panels at both ends of the face, and thus the throttle valves of both motors are actuated simultaneously.

KNOW YOUR STEEL

A shallow groove rolled along the entire length of the bar has been suggested as a useful method of identifying different types of drill-steel in circumstances where confusion might arise. Such a marking is not destroyed by use, and modifications of it, such as interrupted groove, coded dash-dot, double groove, etc., are easily devised to identify as many different types of steel as a particular case demands.



Above: The new lightweight geiger counter introduced by Radiation Monitors Ltd.

Below: P.V.C. conveyor belting for delivery to the N.C.B.

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Metals and Minerals

Boron's Growing Field of Applications

Boron and its prospects were discussed by D. S. Dinsmoor and F. J. Weishaupl, of the American Potash and Chemical Corporation, at the annual convention of the American Institute of Mining, Metallurgical and Petroleum Engineers. Borate production in the U.S. is now about 900,000 tons a year. The element itself is today available as a very fine amorphous product of 90-92 per cent purity at a price of $13 per lb. Various special grades and higher purity grades are also offered. Pure crystalline boron is available in small quantities at a much higher price.

The potential uses of the element are due to its high heat of combustion (about 25,000 B.T.U. per lb.) and its ability to absorb neutrons. Current applications are in flares, igniters, and in atomic energy shielding compositions. Another newcomer in recent years is boric oxide, which is the anhydrous form of boric acid. This is used primarily in the manufacture of elemental boron and other boron compounds. Boron trifluoride is extensively used as a catalyst in the petroleum field. Two more recent products, boron trichloride and boron tribromide, are being produced on a semi-commercial scale and have possible applications in the refining of zinc, copper, and aluminium; as catalysts; as condensing agents; and for the control of magnesium metal fires. There has recently been a renewed interest in boron nitride, which has never been extensively used industrially, as well as in the borazoles—more complex compounds of boron and nitrogen, which are now undergoing study.

Among the simpler boron compounds are the metal borides such as titanium boride and aluminium boride, which are of interest in high-temperature technology and because of low electric resistance. Boron carbide has limited use as an abrasive. Small amounts of boron added to steel can reduce the amount of nickel, chromium, or molybdenum required.

A series of boron-phosphorus compounds is still in the exploratory stage, but it has already been established that some of the simpler members exhibit high thermal stability. Development work in this field is directed towards the production of liquid or solid polymers.

Boron combinations with hydrogen are usually thought of when speculating about high-energy fuels. Yet these compounds, because of their high reactivity, and in some instances their relatively high toxicity, appear to be of potential interest in industrial applications. The borohydrides have for some time been offered in commercial quantities and have specific uses as selective reducing agents in organic syntheses.

Perhaps the boron compounds which have received most attention in the last two or three years are the boron-oxygen-carbon compounds in which the boron is linked directly with oxygen. These include the borate esters such as methyl borate and propyl borate and the acid anhydrides such as boron acetate. A wide range of such products has become available in the last two or three years and these are being tested as possible ingredients in insecticides, pharmaceuticals, hydraulic fluids, stabilizers in plastics, and in paints and enamels.

Government work is bringing the high-energy fuels containing a boron base close to practical use and their impact on the mineral industry—i.e. the borax producers—may be very great. It was noted at the convention, however, that the future for boron in high-energy fuels is still highly speculative, having regard to possible developments relating to such new fuels with fluorine, hydrogen, and perhaps other gases.

LOYALTY DISCOUNTS FOR CANADIAN ALUMINIUM

Providing U.K. consumers agree to take no other aluminium than Canadian, Aluminium Ltd. of Canada offers a 2 per cent "Loyalty Discount" on its price which currently stands at £197 per ton delivered U.K. for ingots having a minimum 99.5 per cent purity. "Loyalty Discounts" have been in force for about three months and have been introduced as a means of combating Russian competition. Aluminium Ltd. is also offering certain financial facilities which allow consumers to pay only when the metal goes into consumption. Russian aluminium, which is comparable in quality to Canadian metal, is available to U.K. consumers at a price of approximately £182 per ton delivered.

BISMUTH'S BRIGHT PROSPECTS

New applications for bismuth were described at the A.I.M.E. convention by representatives of the Cerro de Pasco Corporation, who foresaw a very bright future for bismuth alloys.

In a paper on "Bismuth Recovery at Oroya", Mr. Walter C. Smith, a consulting metallurgist of New York, and Mr. Philip J. Hickey, superintendent of smelting and refining at La Oroya, recalled that up to about 1930 the only important use of bismuth was in the field of pharmaceuticals, and the supply was more or less in balance with the demand. At that time, bismuth alloys existed chiefly as laboratory curiosities. When it became evident that Cerro de Pasco had resources of bismuth sufficient to make it potentially a major producer, the company embarked upon metallurgical research and development on an extensive scale and a considerable amount of missionary work was undertaken to promote new uses.

Today, uses of bismuth melting alloys are constantly expanding from one industry to others, and new applications are continually being discovered. Of late, a market of potentially large proportions has sprung up in the atomic industry, which is currently using some bismuths in liquid metal-cooled reactors and also for shielding. It can be assumed that, if these reactors are successful and commercial power stations of this type are erected, bismuth will be in short supply.

Some of the anticipated future need for bismuth in the atomic field will be for metal of ultra-purity. Even bismuth containing less than 15 p.p.m. of total impurities is not considered sufficiently pure. Studies now under way indicate that the costs of upgrading the present C. de P. product will be very high, but, granting sufficient demand, the necessary techniques can be mastered.

IMPROVED CADMIUM RECOVERY

The progress of cadmium was surveyed at the A.I.M.E. convention by Mr. Alfred I. Alf, superintendent of the cadmium, indium, and rare metals division of the Great Falls reduction department of the Anaconda Co., Great Falls, Montana. Mr. Alf pointed out that through the years cadmium, like many other metals, had grown from a position of obscurity and neglect to its present status of a much-wanted and valuable metal.

Most of the cadmium produced is used in the plating industry as a corrosion-resistant coating on iron and steel. Cadmium-base bearing metals are used for high-speed automotive, aircraft and marine engines that operate at high temperatures. A small but important application is in the Weston standard cell. Another relatively small use of the metal is in the nickel-cadmium storage battery. Cadmium is also a constituent of many solders. Finally, since the advent of the atomic era, an unpublished amount of cadmium has been used in atomic reactors as a means of controlling the reaction.

Cadmium production in the United States in 1956 approximated 5,216 s.tons. About 18 per cent of this production is from the Great Falls, Montana, plant of the Anaconda Co.

Mr. Alf noted that, because of the large increase in demand after 1935, the retort smelters improved their metallurgy by adjusting the sintering process so as to increase the elimination of cadmium, and recover cadmium that had previously been wasted. In some lead blast-furnace operations, where zinc and cadmium are present in the furnace charges, a cadmium-bearing fume results. Similarly, some copper-smelting operations also produce a cadmium-bearing fume. In recent years an effort has been made to up-grade these fumes and recover their cadmium content.

Mr. Alf described in some detail a process developed by Anaconda for the recovery of cadmium from zinc concentrates at Great Falls.

TITANIUM FOR NEW PROJECTS

To enable engineers and designers to examine for themselves the properties of titanium in new projects, Wm. Jessop and Sons announce they are prepared to offer development supplies of "Hylite" titanium on specially attractive terms.

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Boron and its prospects were discussed by D. S. Dinsmoor and F. J. Weishaupl, of the American Potash and Chemical Corporation, at the annual convention of the American Institute of Mining, Metallurgical and Petroleum Engineers. Borate production in the U.S. is now about 900,000 tons a year. The element itself is today available as a very fine amorphous product of 90-92 per cent purity at a price of $13 per lb. Various special grades and higher purity grades are also offered. Pure crystalline boron is available in small quantities at a much higher price.

The potential uses of the element are due to its high heat of combustion (about 25,000 B.T.U. per lb.) and its ability to absorb neutrons. Current applications are in flares, igniters, and in atomic energy shielding compositions. Another newcomer in recent years is boric oxide, which is the anhydrous form of boric acid. This is used primarily in the manufacture of elemental boron and other boron compounds. Boron trifluoride is extensively used as a catalyst in the petroleum field. Two more recent products, boron trichloride and boron tribromide, are being produced on a semi-commercial scale and have possible applications in the refining of zinc, copper, and aluminium; as catalysts; as condensing agents; and for the control of magnesium metal fires. There has recently been a renewed interest in boron nitride, which has never been extensively used industrially, as well as in the borazoles—more complex compounds of boron and nitrogen, which are now undergoing study.

Among the simpler boron compounds are the metal borides such as titanium boride and aluminium boride, which are of interest in high-temperature technology and because of low electric resistance. Boron carbide has limited use as an abrasive. Small amounts of boron added to steel can reduce the amount of nickel, chromium, or molybdenum required.

A series of boron-phosphorus compounds is still in the exploratory stage, but it has already been established that some of the simpler members exhibit high thermal stability. Development work in this field is directed towards the production of liquid or solid polymers.

Boron combinations with hydrogen are usually thought of when speculating about high-energy fuels. Yet these compounds, because of their high reactivity, and in some instances their relatively high toxicity, appear to be of potential interest in industrial applications. The borohydrides have for some time been offered in commercial quantities and have specific uses as selective reducing agents in organic syntheses.

Perhaps the boron compounds which have received most attention in the last two or three years are the boron-oxygen-carbon compounds in which the boron is linked directly with oxygen. These include the borate esters such as methyl borate and propyl borate and the acid anhydrides such as boron acetate. A wide range of such products has become available in the last two or three years and these are being tested as possible ingredients in insecticides, pharmaceuticals, hydraulic fluids, stabilizers in plastics, and in paints and enamels.

Government work is bringing the high-energy fuels containing a boron base close to practical use and their impact on the mineral industry—i.e. the borax producers—may be very great. It was noted at the convention, however, that the future for boron in high-energy fuels is still highly speculative, having regard to possible developments relating to such new fuels with fluorine, hydrogen, and perhaps other gases.

LOYALTY DISCOUNTS FOR CANADIAN ALUMINIUM

Providing U.K. consumers agree to take no other aluminium than Canadian, Aluminium Ltd. of Canada offers a 2 per cent "Loyalty Discount" on its price which currently stands at £197 per ton delivered U.K. for ingots having a minimum 99.5 per cent purity. "Loyalty Discounts" have been in force for about three months and have been introduced as a means of combating Russian competition. Aluminium Ltd. is also offering certain financial facilities which allow consumers to pay only when the metal goes into consumption. Russian aluminium, which is comparable in quality to Canadian metal, is available to U.K. consumers at a price of approximately £182 per ton delivered.

BISMUTH'S BRIGHT PROSPECTS

New applications for bismuth were described at the A.I.M.E. convention by representatives of the Cerro de Pasco Corporation, who foresaw a very bright future for bismuth alloys.

In a paper on "Bismuth Recovery at Oroya", Mr. Walter C. Smith, a consulting metallurgist of New York, and Mr. Philip J. Hickey, superintendent of smelting and refining at La Oroya, recalled that up to about 1930 the only important use of bismuth was in the field of pharmaceuticals, and the supply was more or less in balance with the demand. At that time, bismuth alloys existed chiefly as laboratory curiosities. When it became evident that Cerro de Pasco had resources of bismuth sufficient to make it potentially a major producer, the company embarked upon metallurgical research and development on an extensive scale and a considerable amount of missionary work was undertaken to promote new uses.

Today, uses of bismuth melting alloys are constantly expanding from one industry to others, and new applications are continually being discovered. Of late, a market of potentially large proportions has sprung up in the atomic industry, which is currently using some bismuths in liquid metal-cooled reactors and also for shielding. It can be assumed that, if these reactors are successful and commercial power stations of this type are erected, bismuth will be in short supply.

Some of the anticipated future need for bismuth in the atomic field will be for metal of ultra-purity. Even bismuth containing less than 15 p.p.m. of total impurities is not considered sufficiently pure. Studies now under way indicate that the costs of upgrading the present C. de P. product will be very high, but, granting sufficient demand, the necessary techniques can be mastered.

IMPROVED CADMIUM RECOVERY

The progress of cadmium was surveyed at the A.I.M.E. convention by Mr. Alfred I. Alf, superintendent of the cadmium, indium, and rare metals division of the Great Falls reduction department of the Anaconda Co., Great Falls, Montana. Mr. Alf pointed out that through the years cadmium, like many other metals, had grown from a position of obscurity and neglect to its present status of a much-wanted and valuable metal.

Most of the cadmium produced is used in the plating industry as a corrosion-resistant coating on iron and steel. Cadmium-base bearing metals are used for high-speed automotive, aircraft and marine engines that operate at high temperatures. A small but important application is in the Weston standard cell. Another relatively small use of the metal is in the nickel-cadmium storage battery. Cadmium is also a constituent of many solders. Finally, since the advent of the atomic era, an unpublished amount of cadmium has been used in atomic reactors as a means of controlling the reaction.

Cadmium production in the United States in 1956 approximated 5,216 s.tons. About 18 per cent of this production is from the Great Falls, Montana, plant of the Anaconda Co.

Mr. Alf noted that, because of the large increase in demand after 1935, the retort smelters improved their metallurgy by adjusting the sintering process so as to increase the elimination of cadmium, and recover cadmium that had previously been wasted. In some lead blast-furnace operations, where zinc and cadmium are present in the furnace charges, a cadmium-bearing fume results. Similarly, some copper-smelting operations also produce a cadmium-bearing fume. In recent years an effort has been made to up-grade these fumes and recover their cadmium content.

Mr. Alf described in some detail a process developed by Anaconda for the recovery of cadmium from zinc concentrates at Great Falls.

TITANIUM FOR NEW PROJECTS

To enable engineers and designers to examine for themselves the properties of titanium in new projects, Wm. Jessop and Sons announce they are prepared to offer development supplies of "Hylite" titanium on specially attractive terms.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

In spite of a firmer undertone in the copper market, prices themselves show very little alteration from last week, whilst in the lead and zinc markets a weaker tendency has developed with a contango appearing again in the zinc market.

IS COPPER ON THE TURN?

The copper market is at one of those periods when opinion is almost equally divided about the immediate trend in prices. The "bears" point out that there is still a surplus of production over consumption, and that even if steps are taken to reduce the former further, it will be many months before the effects are felt in the open market. The "bulls" point out that all the surplus copper appears to be in America and that metal elsewhere is by no means plentiful, which could result in the necessity for the London price to go above the American level to attract copper out of that country. They also point out that the latest action by Kennecott indicates that producers are still prepared to do something about over-production, and that the London market nearly always discounts coming events and does not bide its time until the actual results of any action make themselves felt.

Kennecott announced on Monday that their four Western mining divisions would reduce their production week from six to five days, and that this would result in an overall curtailment, including that made in January, of about 20½ per cent of their former capacity operations. Observers estimate that this may amount to some 7,000 tons a month.

The news from the consumer front in America, however, is still very gloomy, and were it not for the Administration's obvious desire to do something, the latest unemployment figures would have undermined confidence still further. The Bureau of Mines reports that available supplies of copper exceeded demand throughout 1957, as although production from domestic sources decreased by about 3 per cent, there was a decrease over the first eleven months of the year of 11 per cent in the consumption of refined copper and producers' stocks rose by 26 per cent to a total of 98,000 s.tons by the end of the year.

Inquiries from Europe for copper are becoming more numerous, but actual business is hard to conclude, and on the London market activity has been satisfactory with both the contango and the official stocks remaining almost unaltered.

EASTERN PRICE ERRATIC

The tin market was unaffected by the results of the International Tin Council's meeting and nothing of importance was made known, except that the present quotas were to remain unaltered and that the next meeting was to take place on April 29. The main interest was centred on the surprise reduction in stocks of 606 tons and the amount of cash metal which changed hands during the earlier part of the week above the buffer pool's support price. This latter offering of cash metal was responsible for a weaker tone in the whole market, but it is considered that as soon as this ceases prices will rise sharply.

Nothing more has been published to clarify the position with regard to Indonesian production, and it was interesting to hear that tin-in-ore shipments from that country during 1957 totalled 26,963 l.tons, as compared with 31,156 l.tons in 1956. Of special interest was the fact that in December 1,422 tons were shipped to the United States. The results of the increasing trouble in the area were reflected in the fact that shipments in January only totalled 967 tons in all.

In the East, the market has been very volatile and this is probably due to the fact that smelter intakes are now becoming very irregular owing to the quota restrictions, added to which it is understood that Japan has been an intermittent buyer. On Thursday morning the Eastern price was equivalent to £752½ per ton c.i.f. Europe.

LEAD-ZINC AWAIT TARIFF NEWS

The lead and zinc markets have again been featureless, with the exception of the establishment of the contango in the latter market after a small backwardation had existed for the first few days of the period. The forward position in this market was also helped to a small extent by the American Zinc Institute's figures for February, which showed a reduction in production from 82,343 s.tons in January to 68,354 in February. The total shipments, however, were still endeavouring to absorb the whole of the production, and stocks rose by a further 9,000 s.tons, which is nevertheless at a slower monthly rate than has prevailed recently.

The demand for lead on the London market from America still continues and this is the main reason for the continuation of the backwardation, although it is expected that this will soon cease as it is now rumoured that the Tariff Commission's recommendations will be published by the end of this month, and it is therefore possible that some action to increase the tariffs may be taken to come into effect from May 1, although past experience makes a later date more likely.

Closing prices are as follows:—

	Mar. 6 Buyers	Mar. 6 Sellers	Mar. 13 Buyers	Mar. 13 Sellers
COPPER				
Cash	£166	£166½	£164½	£165
Three months	£168½	£168½	£167	£167½
Settlement	£166½		£165	
Week's turnover	10,875 tons		8,925 tons	
LEAD				
Current ½ month	£75½	£75½	£74½	£74½
Three months	£75	£75½	£74½	£74½
Week's turnover	3,025 tons		5,375 tons	
TIN				
Cash	£734	£735	£731	£731½
Three months	£740	£741	£736	£737
Settlement	£735		£731½	
Week's turnover	735 tons		1,690 tons	
ZINC				
Current ½ month	£64	£64½	£62½	£63
Three months	£63½	£64	£63½	£63½
Week's turnover	3,775 tons		4,725 tons	

LONDON METAL AND ORE PRICES, MAR. 13, 1958

METAL PRICES

Aluminium, 99.5%, £197 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Crude (70%) £190 per ton
Ore (60%) basis 19s. 6d./20s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom
Cadmium 10s. 0d. lb.
Cerium (99% net), £13 18s. lb. delivered U.K.
Chromium, Cr. 99% 7s. 2d. lb.
Cobalt, 16s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 8d. per gram
Gold, 249s. 3½d.
Iridium, £26 oz. nom.
Lanthanum (98/99%) 15s. per gram.
Manganese Metal (96%-98%) £310
Magnesium, 2s. 5½d. lb.
Nickel, 99.5% (home trade) £600 per ton
Osmium, £20/22 oz.
Osmiridium, nom.
Palladium, £7 10s. oz.
Platinum U.K. and Empire Refined £27/10 oz, Imported £24/£24 10s.
Quicksilver, £77/£78 ex-warehouse
Rhodium, £40/£42 oz.
Ruthenium, £15/£18 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 76½d. f. oz. spot and 76½d. f'd.
Tellurium, 15s. 16s. lb.

ORES AND OXIDES

Biamuth .. .. 30% 5s. 0d. lb. c.i.f.
20% 3s. 3d. lb. c.i.f.

Chrome Ore—
Rhodesian Metallurgical (semifriable) 48% .. .. £17 5s. 0d. per ton c.i.f.
" Hard Lumpy 45% .. .. £18 0s. 0d. per ton c.i.f.
" Refractory 40% .. .. £12 5s. 0d. per ton c.i.f.
" Smalls 44% .. .. £16 5s. 0d. per ton c.i.f.
Baluchistan 48% .. .. £12 0s. 0d. per ton f.o.b.
Columbite, 65% combined oxides, high grade .. .. nom.

Fluorspar—
Acid Grade, Flotated Material .. .. £22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2) .. .. 156s. 0d. ex works

Lithium Ore—
Petalite min. 3½% Li_2O .. .. 47s. 6d./52s. 6d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O .. .. 47s. 6d./52s. 6d. per unit f.o.b. Beira
Ambigonite basis 7% Li_2O .. .. £26 5s. per ton f.o.b. Beira
Magnesite, ground calcined .. .. £28 0s./£30 0s. d/d
Magnesite Raw (ground) .. .. £21 0s./£22 0s. d/d
Manganese Ore Indian—
Europe (46%-48%) basis 77s. 6d. freight .. .. nom.
Manganese Ore (43%-45%) .. .. nom.
Manganese Ore (38%-40%) .. .. nom.
Molybdenite (85% basis) .. .. 9s. 5d. per lb. (f.o.b.)

Titanium Ore—
Rutile 95/97% TiO_2 (prompt delivery) .. .. £39/£40 per ton c.i.f. Aust'n.
Ilmenite 52/54% TiO_2 .. .. £11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%) .. .. 95s. 0d./100s. 0d. per unit c.i.f.

Vanadium—
Fused oxide 90-95% V_2O_5 .. .. £10 per unit c.i.f.
Zircon Sand (Australian) (63-66% ZrO_2) .. .. £16 per ton c.i.f.

Mining Finance

Ashanti Confirms Expectations

The extremely healthy and promising technical position at Ashanti Goldfields has been constantly referred to in these columns, and the annual report for the year to last September does no more than re-tell the story—record tonnage, record gold yield, excellent development disclosures, improved metallurgy. After all this, it has come as an anti-climax to some investors to see what appears at first sight to be a substantial fall in ore reserve tonnages.

In fact, this is no more than a paper loss. Ashanti has always had difficulty with a graphitic schist associated with fissure margins. This barren rock frequently adulterated the high-grade quartz reef, causing unproductive expense in hauling, hoisting and treating, and a downward pressure on the mill grade. Methods of mining designed to produce a cleaner reef have now been evolved and put into operation, and these necessitated a re-appraisal of ore reserve values which resulted in the exclusion of much previously included unpayable rock. What has happened in effect is the introduction of waste-sorting by the simplest method of all—not mining it—and the usual benefits of this practice may be confidently anticipated in the future.

By comparison, the picture at Bibiani, Ashanti's less glamorous stablemate, seems almost pedestrian. The future of this mine depends on the discovery of new major orebodies, and to this end exploratory development has been considerably intensified. Work last year was concentrated on 19 and 20 levels at the south of the mine, where disclosures were promising, but not on the scale required. In the current year the north end is being tested on levels 21-24, with diamond-drilling playing an increasing part. Other than this, development now consists entirely of stope-preparing work. Nevertheless, Bibiani does not intend to go down without a fight, and throughput is being steadily raised from last year's record to a new high point of 35,000 tons monthly. The management's perseverance deserves success.

TWO MINES WITH PROBLEMS

The problems facing Ghana Main Reef and Ariston Gold Mines are quite different, in spite of the fact that the properties are next-door neighbours. In last week's *Mining Journal* it was anticipated that a severe cost increase was the explanation of Ariston's comparatively stationary profits in the face of substantial grade improvements. This is now confirmed in the full report and accounts now published. Ariston's problem is, therefore, how to slow down cost-inflation so that the rising grade may be reflected in the profit and loss account.

At Ghana Main Reef, on the other hand, the dog is at the opposite end of the manger. This company achieved the remarkable feat of reducing costs per ton milled by no less than 8s. 8d. Like Ariston, however, profit remained almost stationary, declining grade (1956, 7.1 dwt. per ton; 1957, 6.2 dwt. per ton) being to blame. The grade position at this mine is so difficult, in fact, that the general manager, in his report, says that "the only thing to do is to run faster in order to remain where we are". This policy was followed last year, with the result that throughput totalled 142,395 tons, compared with 114,063 tons in the last full year before the strike. Full capacity has now been attained, however. At Ariston, too, throughput is increasing, but in the last resort the tonnage treated in the mill is limited by what can be hauled out of the mine, which in turn is dependent on what new ore can be found. Here again the position is dissimilar.

At Ariston development is being rapidly accelerated, and results are encouraging; 13,124 ft. were accomplished during the year, compared with 7,815 in 1954-55, and from the results it appears that both of the mine's major sources of ore are improving at depth, the North orebody in length, and the No. 2 in values. A substantial tonnage was thus added to reserves, the value and width of which also improved. At development footage at Ghana Main Reef, on the other hand, the rate of development has if anything decreased, and although some extremely good results have been (and are being) achieved in the Tuappim section, exploratory development in the Main Shaft and Ekotokroo sections has only been sporadically encouraging. Nevertheless, the year to June last saw an increase in ore reserves, with slight grade and width improvements as a bonus.

Thus it may be said that in the short term Ariston's problem is nearer solution than that of its neighbour. In the longer term, Ghana Main Reef must increase its

LONDON MARKET HIGHLIGHTS

By far the most outstanding feature of mining markets on the London Stock Exchange last week was the fast and furious rise in copper share prices which accompanied one of the worst bear squeezes for many a year.

Few dealers had much stock on their books, and in addition to this many "short" positions existed on the view that share prices had still not come back sufficiently to discount the heavy fall in the metal price and in copper producers' earnings. At the same time a similar bear position existed on Wall Street.

Against this, last week saw the end of the financial year for many London firms, who in the course of levelling-up their books found it necessary to buy copper shares. On Wall Street the view gained ground that the recession had at last levelled out and that despite the high unemployment figure for February things were not so black as they had been painted.

Following Wall Street's recovery, a spate of buying began here with the result that before anyone quite realized what was happening copper share prices were soaring. Dealers bid ever higher in order to get the shares to satisfy demand. At the same time, bears scrambled to close their dangerous short positions. The result was a complete rout.

Prices quickly reacted whenever the buying slackened, but were just as quick to rise again. The actual amount of business was out of all proportion to the rise in share values, which put on several shillings in a few days. Nchanga at one time had risen 14s. in three days to 187s. 6d., Rhodesian Anglo American 5s. to 61s. 3d. and R.S.T. 2s. to 16s. 6d. Bancroft, which reached 16s. 6d., were always an active market, and Rhodesia-Katanga signalled the entry of the quick profit brigade by suddenly spurting 3s. to 12s. 6d. before later reacting to 11s. 9d. on profit-taking. All these movements were technically inspired, but there was some genuine investment demand behind the 5s. rise to 55s. in Chartered; the annual report made a good impression and news of the company's O.T.C. ranking was a bullish factor.

Nobody cares to predict the immediate future of the copper share market. If prices were considered too high before the boom, they must be hopelessly out of line now. But at the same time, if Wall Street continues to recover, share values will rise with the metal price. At this stage everything depends on whether the Eisenhower administration can restore business confidence in the United States. Until the picture becomes clearer, London share and metal markets will dance to Wall Street's tune.

Even gold shares came under United States influence, because when Wall Street rallied, the little spring-time that had previously been felt in the South African gold share market quickly evaporated. Prices edged a few pence lower on the absence of further buying support and even the appearance of the Anglo American March dividends had little effect. The only disappointment in these dividends was that of President Steyn, and the shares eased 6d. to 28s. 6d. Otherwise the payments were up to best expectations, particularly that of Free State Geduld, which at 2s. was more than many observers had expected.

One of the few bright spots was provided by New Pioneer, which responded to a persistent investment demand by gaining 1s. 9d. to 29s. 6d. Ashanti (13s. 6d.) also improved, being helped by the annual report.

Lead-zincs moved in sympathy with Coppers, but price changes were much less violent. Even so, Consolidated Zinc were 2s. 3d. up over the period at 48s. Lake George jumped 1s. 4½d. to 4s., and it was thought possible that the mine had succeeded in obtaining the Government assistance mentioned at the recent annual meeting.

throughput if it is to achieve stability, and it seems that something of this sort may have been behind the decision not to pay a dividend for 1956-57 in order to "rebuild and maintain the sound financial structure of the company" damaged by the 1955-56 labour troubles.

ANGLO-FRENCH RIGHTS ISSUE

In one rather perverse sense, the recent bear market in gold shares has been of value to finance and investment houses with commitments in this sector of the market. This situation arises because most of these companies have written off quite considerable sums from their holdings in an attempt to maintain realistic portfolio valuations during the past two or three years. Hence, should the long-awaited Kaffir boom materialize, companies like Anglo-French Exploration (whose portfolio normally consists of about 50 per cent gold shares and the rest oil and base metals) may well find themselves with a valuable selection of investments standing in their balance sheets at extremely low values.

However, writing-off is, at the moment, still the order of the day, and Anglo-French is no exception, having applied over £10,000 of profits in this way in 1957. After all charges (including almost 50 per cent for taxation) the company's profit was slightly better than in 1956, allowing the maintenance of a 1s. 10½d. dividend rate. In order to provide funds to take up the shares to which Anglo-French is from time to time entitled, there is to be a rights issue of 100,000 £1 shares at par at the rate of one for nine. The issue will not be underwritten. It is anticipated that the 1s. 10½d. distribution rate will be maintained this year on the increased capital.

O.F.S. DIVIDEND SEASON OPENS

The March dividends of the O.F.S. producers of the Anglo American group contained two surprises, one pleasant and the other not so. The doubled distribution from F. S. Geduld was more than even the optimists had expected in view of F.S.G.'s obligation to repay an amount of loan equal to the cost of dividends. The present small amount of loan outstanding augurs well for the next distribution. President Steyn, on the other hand, caused consternation by reducing its distribution. It is probably safe to assume, however, that this step is no more than an indication that the mine's growing pains are over and that in future dividends will be declared on an interim and final basis—Anglo's normal practice. A comparative table appears below.

	Mar. 1958	*Sept.* 1957	*Mar.* 1957	*Sept.* 1956
	s. d.	*s. d.*	*s. d.*	*s. d.*
F. S. Geduld	2 0	1 0	—	—
P. Brand ...	2 6	2 6	2 6	2 0
P. Steyn ...	1 3	1 6	1 3	1 0
Welkom ...	3	3	—	—
W. Holdings	3 0	3 0	2 0	2 0

Blinkpoort Gold Syndicate, largely dependent on the O.F.S. dividends for its own revenue, is paying 25 per cent. This compares with 3¾ per cent last March and a total of 17½ per cent last year.

Coincident with the publication of these dividends comes news of a new shaft intersection at President Brand. A complete exposure of the Basal reef in the No. 2 Sub-vertical shaft assayed 14¼ dwt. over 43¼ in., or 631 in. dwt. This is much in line with development in the area. The uranium value was 34.27 in. lb.

IT ALL DEPENDS ON DALNY

It is quite clear from the report and accounts of Falcon Mines, the Rhodesian gold producer, that profitability now depends almost entirely on results at the Dalny Mine. The Sunace Mine is now engaged on reclamation work only and at the Bay Horse property, development results have continued poor to such an extent that unless an improvement transpires operations may soon have to cease.

In view of this, work has been proceeding during the past year with the ultimate object of raising mill capacity from 15,000 to 20,000 tons monthly. This work is now completed, but the mill was not commissioned until October last year, one month too late to have any effect on Falcon's results for the last financial year.

The effect of the additional mill capacity will be two-fold. The obvious advantage will be the additional profit-earning capacity, but less obvious is the fact that profit-distributing capacity will also be enhanced. Last year, for example, from a net profit of £103,685 the sum of £20,000 was appropriated to cover capital expenditure of almost £62,000, all at Dalny, while the unchanged dividend of 10½d. per stock unit absorbed £79,433. If it be assumed that all the profit would be available for distribution in coming years, Falcon could pay something like 1s. 2d. annually, assuming that the loss of profit from the closing of Sunace and Bay Horse is more or less counterbalanced by the increased capacity at Dalny.

Development results at Dalny in the 1957 financial year were disappointing taken out of their context, but the chairman, Mr. F. L. Wigley, extracts from whose circulated statement appear on page 306, points out that a large proportion of the footage was accomplished in areas outside the known areas of enrichment for technical reasons.

INDIA AND THE OVERSEAS BANKS

The common problem of three of Britain's great overseas banking organizations—National Overseas and Grindlays, Chartered Bank and the Mercantile Bank—is India. It must almost be a fact of life to these banks that India lives on borrowed time and borrowed money.

A situation of this kind is obviously unstable. Inflationary forces are generated, and unless they are extremely firmly controlled can easily run away. Above all, only a small setback is needed to bring the whole structure tumbling.

The poor monsoon experienced last year could easily have been the fatal setback, and the Mundhra affair, with the subsequent resignation of Mr. Krishnamachari, might well have given the Indian economy another push on the way down. However, it appears that the Indian Government's undoubted energy was at last applied in the right place and at the right time, and precarious though the situation may be, it seems that the *status quo* can be maintained for a further year. More than this, India is now having more success in arranging credit over longer periods and the time when pressure will begin to ease may not be too distant.

However, from the statements by the chairmen of National Overseas (on page 307) and of the Chartered Bank (page 305), it is apparent that no undue risks are being taken by the financing organizations, and spreading of interests is the order of the day. National Overseas is pushing ahead into East Africa, while Chartered is breaking new ground in the Middle East.

MANGULA THE REMARKABLE

As if it was not enough to start production eighteen months ahead of schedule, M.T.D. (Mangula) has now disclosed an even more remarkable achievement. Speaking at the annual meeting in Salisbury this week, Commander H. Grenfell, chairman of this most energetic of companies, said that even at the present copper price Mangula was breaking even.

The significance of this lies in the fact that the ore reserves so far proven by the company, grade about 1¼ per cent copper—in money terms this means that at a price of £330 per ton for Mangula's 50 per cent concentrates, the revenue for each ton of ore milled is no more than 17s. 7d. To bring costs down to this level within six months of the commencement of production (which in any case is at half-cock, a normally expensive situation) makes the outlook encouraging.

It may well be felt that Mangula's shares standing a little below par are beginning to look quite cheap.

O.T.C. Status For Mason and Barry.—After consultation with the U.K. taxation authorities, Mason and Barry are satisfied that the company will be granted O.T.C. status. They point out, however, that their accounts for 1957 will be seriously affected by the fall in the selling prices of the company's products.

Fanti To Pay More.—From an increased profit of £69,482 after tax in 1957 (1956: £45,138) Fanti Consolidated Investment Co. is to pay a dividend of 9 per cent together with a bonus of 5 per cent. This compares with a 7½ per cent dividend and a 5 per cent bonus last year.

Akim Pays Maiden.—Results of Akim Concessions for the year to September 30 last are very little changed from the preceding one, net profit before tax being £11,034 against £11,029. Taxation took £5,560 this year, however, against only £1,860 last year. Nevertheless, a maiden dividend of 7.8d. per share is recommended. Meeting, London, March 26.

MINE CAPTAIN

Mine Captain with good experience of underground metalliferous mining (with or without professional qualifications) required for appointment with Konongo Gold Mines Limited, GHANA. The contract is continuous with tours of 12 months and three months' leave on full pay. A provident fund is operated and the Company pays a separation allowance. Applicants, who should, if possible, hold current First Aid and Proto Rescue Certificate, should apply, stating qualifications, experience and salary required, to The Consulting Engineer, New Consolidated Gold Fields Limited, 49 Moorgate, London, E.C.2, England.

THE CHARTERED BANK

IMPROVED EARNINGS

ACQUISITION OF EASTERN BANK

MR. V. A. GRANTHAM ON THE OUTLOOK

The 104th Annual General Meeting of the Chartered Bank will be held on April 2 at 38 Bishopsgate, London, E.C.2.

The following is an extract from the statement by the Chairman, **Mr. V. A. Grantham**, which has been circulated with the report and accounts for the year 1957:

The Bank's Balance Sheet

During the year we acquired by an exchange of shares the entire share capital of the Eastern Bank Ltd., and for cash the business which the Ionian Bank Ltd. conducted in Cyprus, and there are consequential changes both in our Balance Sheet and in the Consolidated Balance Sheet.

Our own Balance Sheet indicates the continued expansion of the Bank's business and reveals a high degree of liquidity. The total at £231,622,655 is the highest we have ever recorded, being some £8,600,000 up on last year's figure.

Current and other accounts and Fixed Deposits show increases of £2,958,494 and £4,499,423 respectively. Our Acceptances are again in excess of £10 millions.

On the assets side, Cash in Hand, at Call, and at Bankers shows the substantial increase of £10,501,948, the ratio to our demand and time liabilities, excluding the notes in circulation against which security has been lodged, being 22.9 per cent against 18.5 per cent last year. Our investments in Government and other securities are slightly lower and, you will note, have again been brought in at market value. Advances and other accounts show a contraction of £6,165,632, which is partially offset by our increased holdings of Bills of Exchange amounting to £4,496,736. Our programme of expansion and modernization of offices and houses in the East has given rise to an increase in the net figure for Bank Premises and Furniture.

The Consolidated Balance Sheet includes the figures of all our wholly owned subsidiaries and the inclusion of the Eastern Bank Ltd.'s figures brings the total to £271,898,015.

Consolidated Profit and Loss Account

I am glad to say that our earnings have improved. The results of the Eastern Bank Ltd., and of our new acquisitions in Cyprus and Pakistan, are included for the first time in our figures.

The Bank paid an interim dividend in September last of 7½ per cent less Income Tax, absorbing £189,750, and it is now proposed that out of the balance available a final dividend of 7½ per cent be paid, costing 189,750, making a total distribution of 15 per cent.

The dividends cost more because of the new issue of capital we made last year, but are more than compensated for by the increase in profits.

We have allocated £250,000 to Bank Premises and Furniture and £125,000 and £20,000 respectively to the Pension Fund and Widows' and Orphans' Fund. We have transferred £220,000 to Reserves for Contingencies and the balance carried forward is £438,458.

Transfers to Bank Premises and Contingencies include this year those made in connection with the Eastern Bank Ltd.

For us, this year is one of consolidation, and in view of the unsettled condition of the world in general it is wise that we should continue to build up the strength of the Bank.

The C.B.I. Development Corporation

Credit restrictions imposed by the Capital Issues Committee of Her Majesty's Treasury have retarded the progress expected of the C.B.I. Development Corporation, but it has been possible during the past twelve months to grant loans of relatively small amounts to finance promising development projects in India, Malaya and Borneo. The Corporation returned a satisfactory profit in 1957 and when conditions more favourable to the undertaking of medium-term credit operations obtain our new organization should rapidly expand.

The Eastern Bank Ltd.

On July 12 last I communicated to the stockholders the terms and conditions of an offer made by the Chartered Bank to acquire the whole of the issued share capital of the Eastern Bank Ltd. To enable the Chartered Bank to issue nine £1 units of its own stock in exchange for two £10 (each £5 paid) shares of the Eastern Bank Ltd., our authorized capital was raised from £3,500,000 to £4,400,000 by a special resolution passed at an extraordinary general meeting of the stockholders held on August 7, 1957. The response to the offer was highly satisfactory, and the holders of approximately 96 per cent of the share capital of the Eastern Bank Ltd. accepted our proposals. Early in December we invoked the provisions of Section 209 of the Companies Act, 1948, to acquire the unassented shares, and we now own the whole of the issued capital of the Eastern Bank Ltd. To complete the operation we issued, as fully paid, new stock in the Chartered Bank to the extent of £900,000 and thereby increased our paid-up capital to £4,400,000. Since the offer closed on August 21 last the operations of the two banks have been progressively co-ordinated.

New Branches

A year ago I stated that the Chartered Bank had acquired by purchase the banking business transacted in Pakistan by the Allahabad Bank Ltd. The former offices of the Allahabad Bank Ltd. at Lahore and Lyallpur have now been fully incorporated within our branch establishment and the Chartered Bank has been enabled thereby to participate to a much fuller extent than was possible previously in financing the up-country trade and industry of Western Pakistan.

To our expanding branch organization in Borneo there was added in April last an office at Sarikei, and we are planning to open in the near future branches at Brunei Town and Kuala Belait.

In order to enlarge further the services we extend to our numerous customers in Singapore a new branch has been opened at Bukit Timah, a thriving industrial suburb of the city, and we have lately leased premises for a new branch in the residential suburb of Tanglin.

Cyprus

Stockholders will have learned from the Press that on November 1, 1957, the Chartered Bank acquired the goodwill of the banking business conducted by the Ionian Bank Ltd. at Nicosia, Famagusta, Kyrenia, Larnaca, Limassol and Paphos in the Colony of Cyprus. The customers of the Ionian Bank Ltd. readily agreed to entrust their business to us, and the transfer was conducted very smoothly indeed. We are grateful for the co-operation and assistance received from the former staff of the Ionian Bank Ltd., all of whom seem to have been happy to join our service.

We have succeeded to an excellent business with the merchant community of Cyprus, a form of banking activity with which we have been familiar throughout our history.

A foothold in the Eastern Mediterranean should ultimately prove to be of great value, and this move may be regarded as part of the policy which prompted us to widen our sphere by interesting ourselves in the Middle East.

Oversea Survey

During 1957 there was no important change in what may be called the strategic disposition of the countries served by the Bank. Pakistan and Iraq continued to adhere to the Baghdad Pact, while India remained the leader of the neutralist powers. The Peoples' Republic of China pursued a policy of non-intervention in the Far East, and its leaders appeared to be preoccupied with domestic affairs, notably in the fields of industrial development and social reform. All the uncommitted Asian countries are clearly anxious to avoid embroilment with either the two major power *blocs* based upon Washington and Moscow, and it is evident that throughout the continent nationalism remains the most powerful political force.

The Sterling Area and the United Kingdom Economy

The appointment of a committee under the chairmanship of Lord Radcliffe to inquire into the working of the monetary system has evoked a good deal of discussion among economists concerning the merits of the sterling area system and the position of this country as its banker.

Widely divergent estimates have been made of the extent to which foreign currency accrues to the United Kingdom Control from the operations of oversea banks based upon or represented in London, and it has been argued that the advantages of those operations to the United Kingdom economy are more apparent than real. The effectiveness of organizations like the Chartered Bank in sustaining the external economic defences of the United Kingdom cannot be in doubt. The Bank finances a very large proportion of the trade in primary products between the eastern countries and the rest of the world, and it is a considerable earner of U.S. dollars and other scarce currencies in its own right; moreover, the Bank is enabled by means of its already extensive and growing oversea establishment to play an important part in the promotion of the export trade of the United Kingdom.

To impose restraint upon the activities of the British oversea banks would be the last resort of the destitute, and it is reassuring to know that changes in currency management and exchange control which might prejudice the unique position of the City of London in international commerce will not be made without the most searching inquiry.

Conclusion

The superficial observer of the contemporary international scene might suppose that few, if any, of the Asian countries hold opportunities for the British banks. There have been reactions against what is loosely and often mistakenly termed "financial imperialism", but most Asian countries realize that an efficient international banking service can play a powerful part in sustaining the economic defences of an undeveloped country struggling to be free and prosperous, and that foreigners practising banking in their territories can be trusted by their hosts.

While our primary function is that of an exchange bank, we have, during the past twenty years, operated to an increasing extent within the domestic economies of the countries to which our organization extends. These credit operations are financed by local deposits and, where they exist, local money-market facilities. In proportion to the extent to which the Bank is permitted to attract deposits, it can, of course, engage in the financing of sound business activities, but there are signs in many countries of a disposition to restrict deposit banking to the indigenous banks.

One of the most striking features that has emerged during the year has been the extent to which the holdings of foreign exchange of so many of the Eastern countries have seriously deteriorated. Attention has been focused on India's position, because of the extent to which she has drawn on her sterling balances, but it is clear that her problem is common to other Asian countries. In nearly all of them there has been the urge towards rapid industrialization, which has caused excessive imports of capital goods and imposed further strain upon dwindling resources of foreign exchange.

It is too soon to anticipate what may be the consequences to the Bank of the impending liberalization of trade within the Western European community, but the pursuit of such a policy would widen markets for the agricultural produce and raw materials which are still of vital importance to most of the Asian national economies. The Bank has a thriving agency in Hamburg and it enjoys mutually satisfactory correspondent relations with an extensive range of banks established on the European continent. Our international organization is well equipped to take advantage of changes in the direction of trade which are likely to result from tariff revision in the United Kingdom and Western Europe.

When addressing the stockholders in past years I have remarked more than once that the Chartered Bank has given many hostages to fortune, but the success with which the affairs of the Bank have been conducted since the end of the war, and the way in which the technique of management has been adapted to meet revolutionized economic situations resulting from changes of sovereignty and other political upheavals encourage me to continue to view with confidence the future of British banking in the East.

Copies of the full text of the statement will be sent on application to the Secretary of the Bank at 38 Bishopsgate, London, E.C.2.

BURMA MINES LIMITED

The following summarises the Operating results of BURMA CORPORATION (1951) LIMITED (Incorporated in the Union of Burma and jointly owned by Burma Mines Limited and the Union Government) for the SIX months ended 31st December, 1957.

ORE EXTRACTION

Quarter ended 30th September, 1957	29,862 tons
Quarter ended 31st December, 1957	29,342 tons
	59,204 tons

PRODUCTION

Quarter Ended	Concentrating Ore Milled (dry tons)	ASSAYS Ozs. Silver	% Lead	% Zinc
30 September 1957	28,370	13.29	16.46	11.46
31 December 1957	29,303	15.18	18.50	12.45
	57,673	14.25	17.50	11.96

Marketable products were as follows :—

Quarter Ended	Refined Lead Tons	Refined Antimonial Lead Tons	Refined and Dore Silver Fine Ozs.	Copper Matte Tons	Nickel Speiss Tons	Zinc Concentrates 54%-57% Zn. Dry Tons
30 September 1957	3,000	99	266,974	90	129	4,196
31 December 1957	3,209	—	292,618	42	6	4,013
	6,209	99	559,592	132	135	8,209

ESTIMATED REVENUE AND EXPENDITURE

	For Quarter ended 31st December, 1957		For the SIX months ended 31st December, 1957	
Gross Revenue (after adjustment of value of Metal Stocks)	K.71,00,700	£532,553	K.1,34,36,400	£1,007,730
Operating Expenditure	K.65,31,500	£489,863	K.1,28,85,400	£966,405
Operating Profit	K.5,69,200	£ 42,690	K. 5,51,000	£ 41,325
Estimated Taxation	K. 23,000	£ 1,725	K. 23,000	£ 1,725
Estimated Depreciation	K. 2,59,000	£ 19,425	K. 5,04,500	£ 37,837
Capital Expenditure	K. 2,92,600	£ 21,945	K. 7,16,400	£ 53,730

The proceeds of sales of products and the value of metal stocks in hand at the end of the Quarter were again adversely affected by the further decline in metal prices. The larger quantities of such stocks, however, principally account for the increase in the figure of gross revenue as compared with the previous Quarter.

The combined result for the SIX months, after allowing for Depreciation and Taxation is an estimated Net Profit of K.23,500 (£1,763) as against K.29,13,400 (£218,505) for the corresponding period of the previous year

The Sterling figures shown are based on a Rate of Exchange of 1/6d. per Kyat.

37, Dover Street, London, W.1.

FALCON MINES

The forty-eighth annual general meeting of Falcon Mines, Ltd., will be held on March 31 at Bulawayo, Southern Rhodesia.

The following is an extract from the Statement of the Chairman, **Mr. F. L. Wigley**, dated February 21, 1958, circulated with the Report and Accounts for the year ended September 30, 1957 :—

The Net Profit for the year was £103,685. An amount of £4,000 has been written off unquoted investments and the sum of £20,000 has been appropriated for expenditure on Fixed Assets and Mine Stores. After providing for Dividends Nos. 7 and 8, totalling 10½d. per share (17½ per cent), which absorbed £79,433, there remained a balance unappropriated of £15,941 compared with £15,964 brought forward from last year.

Dalny Mine

At the Dalny Mine the estimated ore reserve at September 30, 1957, was 536,300 tons valued at 4.32 dwts. per ton over a width of 96 inches, an increase of 14,300 tons but a decrease of 0.38 dwts. per ton in value as compared with the previous year. The drop in ore reserve value is due mainly to the concentration of development effort in the area of 13 level which is being established as the main hauling level. In consequence, less than the normal amount of development has been accomplished in areas of the ore-body which are known to carry values higher than the average.

On the Arlandzer Section at a distance of some 19,500 feet west of the Rix shaft, an incline borehole was drilled to a depth of 587 feet. As announced in the report for the quarter ended September 30, 1957, values were encountered on three horizons and at 304 feet the ore-body assayed 13.3 dwts. per ton over a true width of 44 inches. This borehole was drilled mainly for protection purposes as well as for information and it is our intention to explore the area further at the present time.

It was mentioned in the Chairman's Review last year that it had been decided to increase the capacity of the reduction plant at the Dalny Mine from about 15,000 tons to 20,000 tons per month and also to introduce certain modifications and additions designed to improve the gold extraction. There were some delays in the delivery of the new plant units and the extensions to the mill were not completed until about the end of the financial year. Since the units were commissioned at the beginning of October, 1957, both mechanical and metallurgical difficulties have been experienced but these teething troubles are being overcome.

In conclusion, I wish to place on record our appreciation of the services rendered by Mr. W. D. Hové, the manager of the Dalny Mine, and also to the managers and staffs of all the Company's properties and offices for their loyal and efficient services during the year.

PAKISTAN URANIUM

Doctor Nazir Ahmed, chairman of the Pakistan Atomic Energy Commission, said in Lahore this week that uranium deposits of the "finest quality" had been discovered in the Hazara district of the north-west frontier province.

NATIONAL OVERSEAS AND GRINDLAYS BANK LIMITED

FUSION SMOOTHLY ACCOMPLISHED

MR. J. K. MICHIE'S STATEMENT

The annual general meeting of the National Overseas and Grindlays Bank Limited will be held on April 1 in London.

The following is an extract from the circulated statement of the chairman, **Mr. J. K. Michie :**

The physical amalgamation of the National Bank of India Ltd. and Grindlays Bank Ltd. into the National Overseas and Grindlays Bank Ltd. took effect from January 1, 1958, so, while this is the first report to the shareholders under the new name, the accounts for 1957 perforce are presented in the previous form.

Despite the enormous amount of detailed work involved, thanks to the organizing ability of those specially seconded to the task and to the co-operation of the staffs of both Banks, the fusion was accomplished wonderfully smoothly and I hope without inconvenience to our customers. In a complex operation of this kind, to foresee and anticipate every difficulty would be superhuman, but I am satisfied that any outstanding problems will be disposed of with the sympathy and understanding which were the keynotes of the whole operation.

We have established a 54 Parliament Street Committee of five members, all of whom were on the Board of Grindlays Bank Ltd. This Committee will assist the Management to deal expeditiously with the large number of accounts which they hold and so maintain the very high standard of service associated with the name Grindlays.

Profit and Dividends

Turning to figures, the total of our Consolidated Balance Sheet at £162,105,220 shows a small reduction and our net profit is £5,345 lower at £427,490. As usual, this figure is arrived at after full provision for taxation, for bad and doubtful debts, and other necessary reservations. Two interim dividends each of 7½ per cent have been declared making a total unchanged distribution of 15 per cent.

During 1957 Government securities again fell considerably in value—a process which fortunately has recently been reversed—but I am glad to be able to report that these temporary reductions in value, as in the past, have been provided against internally.

INDIA: 1957 was a difficult year and at the moment prospects for 1958 promise little if any alleviation of her financial problems; in fact, due to a poor monsoon the food situation is less favourable than in recent years, and that means more imports and a greater drain on monetary reserves.

When a country is in process of an industrial expansion at a rate far in excess of its own savings, this, combined with a fall in the values of its basic exports, i.e. jute products, tea and cotton goods, is doubly hurtful. The new investments absorb sterling balances which previously yielded interest; alternatively, they are being built with the help of borrowed money on which, in some form or another and at some time or other, interest will have to be paid. Therefore, temporarily there is a large element of inflation in the phase through which India is passing.

Internally, money is tight and too cheap, and the Government have asked Banks to reduce their lendings. This process would be easier if the Government itself paid its dues somewhat more promptly and recognized that money, too, is a commodity which should only be cheap if it is plentiful.

Another major aggravation of India's difficulties has been the lack of public confidence, as evidenced by a continued fall in Stock Exchange values, accentuated, of course, by the Mundhra incident. In view of the wide publicity being given to this affair, you will be glad to know that our Bank is involved only to a limited extent and full provision has been made in these accounts for any possible loss. It is most regrettable that the involvement of the Life Insurance Corporation in the Mundhra affair has led to the resignation of India's able Finance Minister, Mr. T. T. Krishnamachari.

PAKISTAN: The economy of Pakistan is also under strain. The year 1957 ended with a deficit of over £19,000,000 in the balance of payments as compared with £675,000 in 1956.

Internally, money is in fair supply in Pakistan, but as is now much more generally realized, it is trade balances and external reserves that really matter, and Pakistan has a stern fight ahead of her. Nevertheless, prospects for 1958 are more favourable, but much depends on food production and the slowing down of purchases of capital goods from overseas. The Sui Gas Scheme is also increasingly helpful by saving imports of fuel.

CEYLON: Last year I was able to report a buoyant economy; good prices for tea, and an increased balance of trade, the only clouds being labour relations, particularly in the port of Colombo, and the continued talk of nationalization of tea estates.

Since then tea prices have been volatile and generally lower, and rubber prices also are lower, while recently conditions in the port of Colombo have been chaotic and have caused a severe and crippling hold-up of exports.

It has been stated officially that tea estates in Ceylon would be nationalized only when it became necessary in the interests of the country's economy, and that time has not yet arrived.

BURMA: Unfortunately, 1957 brought the poorest monsoon since 1920 and Burma's rice crop will thrash out 30 per cent short of the previous year, which means the exportable surplus of around one million tons only and a loss of foreign exchange of nearly £30 million. Foreign exchange reserves are already falling and economies will have to be the order of the year. There is a regrettable movement afoot to restrict and even ban internal overdraft facilities to foreign or foreign-controlled companies and firms, and this will affect many of our constituents. It is also very doubtful if it will benefit Burma's trade. The difficulties over remittances, both personal and of accumulated profits, I regret continue.

The Outlook

The reduction of the Bank of England Rate to 5 per cent in February, 1957, proved to be an over-optimistic step, and on September 19 last circumstances demanded that it be again raised, this time drastically to 7 per cent. This unpalatable medicine seems to be working, although the Governor of the Bank of England has just warned us against being too complacent about our progress. There is indeed no panacea in monetary policies by themselves. If they have the desired effects of making us as a country not only tighten our belts but also gird up our loins, then all will be well—otherwise, no.

I have commented in each of my last two statements on the disparity between money rates in countries where it is certainly as scarce as it is here and those prevailing in London. One result of this disparity is a very natural one—for industries and businesses to endeavour to borrow as largely as possible where money is "cheap" and as little as possible when it is not only considerably more expensive, but much harder to come by. This fact is not making our role as overseas bankers any easier, particularly as competition for deposits is growing in every sphere of our activities. It is therefore with interested sincerity that I hope for an easier money market in this country and its reopening on a larger scale to overseas borrowers.

It is impossible to foresee other than a difficult year for commerce, industry, and their hand-maiden banking, but that is no justification for pessimism, and I look forward, albeit not immediately, to a resumption of progress.

THE PROPRIETORS of British Patent No. 700577 for "IMPROVEMENTS IN OR RELATING TO PIT-PROPS AND SIMILAR STANCHIONS", desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2.

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The British Thomson-Houston Co. In 1957

THE past year has seen a continued increase in the demand for the electrical products of the British Thomson-Houston Co. Ltd., an impressive percentage of which were destined for service in the mining industry.

A gearbox for an important colliery installation was dispatched early in 1957. Two twin-pinion winder drives are in process of manufacture, together with a tower-mounted single-reduction gearbox. A further order has been received for a tower-mounted gearbox to transmit 2,000 h.p. with a speed reduction of 500/60 r.p.m. Orders continue to be received for winder auxiliary drives. These include depth indicators, differential drives, and gearboxes with multiple output shafts.

At Baie Comeau, near Quebec, eight rectifier transformers of the sixteen to be supplied have now been commissioned at the new aluminium smelter of the Canadian British Aluminium Co. Ltd. The transformers, which are rated for a rectifier output of 12,100 kW. 850 volts d.c., are probably the largest in the world for this duty. On the Copperbelt, a 13,000-amp. 150-volt unit for the electrolytic refining of copper was commissioned in September. A similar unit, rated 12,000 amp. 150 volt, has been dispatched and will be commissioned early this year.

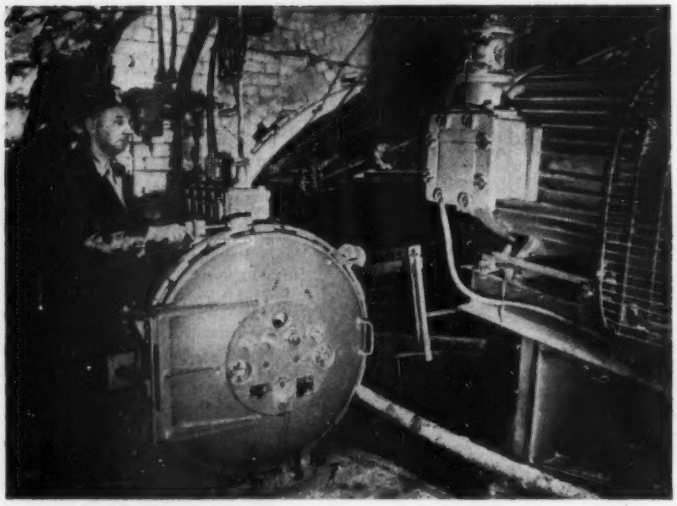
Several important mine winders were installed and commissioned during 1957. The most notable of these is perhaps the 2,500-h.p. twin-rope friction winder installed at Hem Heath Colliery. Many other winders were designed for colliery duties in the United Kingdom. The first of nine mobile emergency winder equipments, for which B.T.H. received the contract for the electrical portion through Messrs. Walker Brothers, has been erected and commissioned. Five more equipments are at present being erected and will be commissioned early in 1958.

Development of the rectifier-controlled electric mine winder has proceeded apace, and great interest is being shown in this type of drive by all concerned with mine hoisting problems.

General Equipment

During the past year several large a.c. motors have been commissioned, including many at U.K. collieries.

Portable mining sub-stations to N.C.B. specifications are still in demand and are being manufactured in considerable quantities. B.T.H. has in hand 200-kVA. underground sub-stations for operation on a 5-kV. system for Eden Colliery, Durham Division. This is a new development, and it will be but a short step to the production of 6.6 kV. sub-stations. Several important switchgear contracts were completed during the year. The final three of the eleven TMC 2453C flameproof air-brake high-voltage control units for the Thurcroft conveyors are now in successful operation at the colliery.



The B.T.H. 3.3-kV. air-brake flameproof reversing contactor at Thurcroft colliery

In the mine car handling field, one of the most interesting projects at present in hand is the surface handling scheme for use in association with the automatic friction winder for the upcast No. 2 shaft at Cynheidre Colliery. The electrical equipment was ordered through Messrs. Dollery and Palmer for use in conjunction with their mechanical equipment, and provides for completely automatic operation, reducing the decking time to a minimum.

Amongst the many other mine car handling schemes which have been commissioned and/or put in hand during the last year are twenty-two duplicate sets of electrical equipment for surface decking rams, supplied to Messrs. Hudswell Clarke for use in the N.C.B. North-Eastern Division, No. 8 Area. In addition, two similar sets of Buxton-certified flameproof equipment have been supplied for use underground. One other scheme at present in hand for Messrs. Plowright Brothers for Ekulu Mine, Nigeria, provides for a continuous stream of mine cars to pass through a ramming, weighing, ramming, and tippling sequence at the rate of 200 cars per hour.

The range of flameproof master control switches has been extended to include the Type MCS 6 remote-control unit and the Type MSB 33 off-load reversing isolator, both designed for use in conjunction with gate-end boxes to N.C.B. specification P 130. Another addition is the Type MC 31 flameproof on-load reversing isolator, intended primarily for mounting on or near motors driving underground machinery where it is required to provide isolation and/or reversing of the motor.

To help meet the ever pressing need for increasing mechanization underground, a novel scheme is in hand for Avon Colliery, N.C.B. South-Western Division, providing automatic operation of an Anbau Hobel plough complete with panzer conveyor driven by the well-known Type KPF 6348 45 h.p. panzer motor. The scheme employs four motors, two for driving the conveyor and two for driving the plough, although the scheme may be readily modified to control any number of motors. Whilst still retaining all the protective features normally associated with gate-end boxes, the control provides for the simultaneous automatic reversal of the plough motors and sequence starting and stopping of the panzer conveyor motors.

B.T.H. Clear-call equipment has now been developed for use on closed-circuit mine car schemes. It is used instead of telephones, and has the advantage that it is brought into action by a foot-operated push-button, thus leaving the operator's hand free for the mine car circuit controls.

The Portavox mine telephone amplifier has now been developed, and the necessary flameproof and intrinsic safety certificates obtained. The equipment is additional to the mine telephone and amplifies the signals normally reproduced by the telephone earpiece so that they are heard through a loudspeaker.

Other Equipments

During the past year Ward-Leonard equipment has been in great demand for excavators, and Ruston Bucyrus 110-RB excavators fitted with B.T.H. electrical equipment are in operation in countries as far apart as Finland, Sweden, Holland, France, Turkey, India, and Australia. In addition, many are in use in Great Britain.

The second W 1400 giant dragline, supplied by Ransomes and Rapier Ltd. to United Steel Companies Ltd. and fitted with B.T.H. electrics, went into operation in September, 1957, to strip overburden from a seam of iron ore.

Orders have been received for the machines and regulating equipment for ore bridges, ore unloaders, and skip hoists for No. 4 blast furnace at Port Kembla, Australia. There will be 34-ton 1,500 h.p. motor generator sets mounted over 100 ft. above ground level. To achieve the desired characteristics, magnestat-controlled amplidynes are being used.

In connection with the motor contract for the Mond Nickel Co. Ltd., the first part of the changeover has been completed with the supply of 910 motors ranging from 1 to 170 h.p. The second part of the changeover and extensions are in hand.

For hard 3-shift running

but easy installation!

A set of three AR3-L compressors, skid-mounted with diesel drive, being installed at one of the mines of the Union Minière du Haut Katanga, in the Belgian Congo.

SPECIALLY DESIGNED TO OPERATE where cooling water is scarce are the Atlas Copco AR-L compressors. They are absolutely self-contained, with a closed-circuit cooling system. Normally they are skidmounted and complete with electric motors, but—as in the instance shown above—they can be operated by diesel engine. These AR-L compressors are easy to install; no concrete foundations are needed, nor any permanent water supply.

Portability plus highest efficiency

Atlas Copco AR-L compressors combine the advantages of water-cooled machines—high efficiency and low discharge air temperature—with those of air-cooled models—easy installation and maintenance. They are cooled by a fan-cooled intercooler and a radiator for the cylinder water. The complete cooling system is a part of the compressor unit, entirely self-contained.

DATA ON AR-L COMPRESSORS

Type	Maximum pressure in psi	Speed in rpm	Capacity in cfm at 100 psi	Power required at 100 psi in hp	Total weight in lbs.
AR1L	125	730	381	80	2,900
AR3L	125	585	646	130	5,300

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The Atlas Copco Group puts compressed air to work for the world. It is the largest group of companies specialising solely in the development and manufacture of compressed air equipment. It embraces Atlas Copco companies or agents manufacturing or selling and servicing Atlas Copco equipment in ninety countries throughout the world. For further details contact your local Atlas Copco company or agent, or write to Atlas Copco AB, Stockholm 1, Sweden, or Atlas Copco (Great Britain) Limited, Beresford Avenue, Wembley, Middlesex.

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- **Heavy brass lock, which can be operated with standard firing key.**
- Weighs only 15 oz. (without detonators).
- Strong belt loops incorporated, integral with box.
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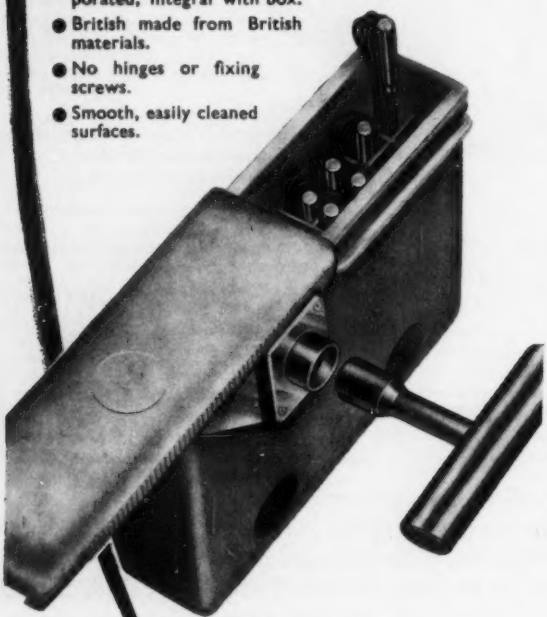

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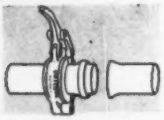
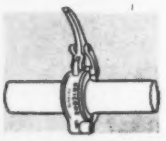
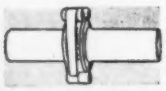


Rubber gasket in position and joint ready to pull over.



Pipe ends joined ready for locking.



The completed joint.

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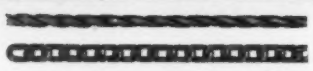

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